Vol. XVIII No. 2

DISSERTATION ABSTRACTS

ABSTRACTS OF DISSERTATIONS AND MONOGRAPHS IN MICROFORM

UNIVERSITY MICROFILMS
ANN ARBOR, MICHIGAN: 1958

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PART I

DISSERTATIONS

AGRICULTURE, GENERAL

THE EFFECT OF DRYING ON EXCHANGEABLE POTASSIUM IN SOILS FROM ILLINOIS AND KANSAS

(Publication No. 25,197)

Robert Arthur Bohannon, Ph.D.
University of Illinois, 1957

A series of desiccators for drying soil samples were constructed for this experiment. Air was circulated within the desiccators, and various concentrations of aqueous sulfuric acid desiccants were used to obtain a desired relative humidity during drying of the soil samples. Constant soil moisture percentages were obtained after moist soils were dried for 96 hours at 25° C.

Four southeastern Kansas soils (Cherokee silt loam, Dennis silt loam, Labette silt loam and Summit silty clay loam) were studied to determine the effect of drying on the exchangeable potassium level in the soil. Field moist soil samples which were taken from each horizon of each soil type were dried under relative humidity conditions ranging from 100 percent to 0 percent. After drying, the soils were analyzed for exchangeable potassium to determine the effect of drying on the level of exchangeable potassium in the soil.

Drying studied indicated that soil samples from all but one of the horizons of the four southeastern Kansas soil types showed increases in exchangeable potassium as a result of drying. In general the drying of samples taken from the B horizons of the soil types studied gave the greatest increases in exchangeable potassium. Pronounced increases in exchangeable potassium generally occurred after the soil moisture percentage was reduced to less than four percent.

Soil drying studies were also made on surface soil samples which were collected from 15 Illinois experiment fields. Exchangeable potassium was determined by using two different methods: (1) sodium nitrate extraction by using a soil:extracting solution ratio of 1:2 and determination by using the sodium cobaltinitrite turbidimetric method, and (2) 1N ammonium acetate extraction by using a soil:extracting solution ratio of 1:10 and determination by means of the flame spectrophotometer.

All Illinois experiment field surface soil samples gave increases in exchangeable potassium as a result of drying. In every instance, oven-dry soil gave the highest amount of exchangeable potassium. In general, exchangeable potassium values for air-dry soil were approximately the same as the exchangeable potassium values obtained when the soil was dried at a relative humidity of 17 percent. The sharpest rise in exchangeable potassium occurred when the soil moisture had dropped to between 3 to 7 percent. Sandy Illinois soils gave small increases in exchangeable potassium while dark colored, heavy textured soils gave large increases as a result of drying.

Neutral ammonium acetate and 23 percent sodium nitrate did not extract the same absolute amount of exchangeable potassium. In general, neutral ammonium acetate was a more efficient extracting reagent for moist soils. As the soils became drier, the efficiency of 23 percent sodium nitrate extracting reagent increased. It appeared that exchangeable potassium values obtained using either method would be useful as a basis for fertilizer recommendations. 118 pages. $2.00. Mic 58-4000

MANAGEMENT DECISIONS DURING DROUGHT PERIODS ON EASTERN OREGON CATTLE RANCHES

(Publication No. 24,637)

James Robert Gray, Ph.D.
Oregon State College, 1957

Major Professor: C. V. Plath

Drought occurs somewhere in the western range area each year. It occurred in eastern Oregon in 1954 and 1955. Drought is defined here as a period in which net returns are reduced because of a deficiency of soil moisture. In the study area of Harney and Malheur counties, Oregon, precipitation (the only available measure of drought) was 17 and 24 percent below normal in 1954 and 1955, respectively.

To meet this drought situation cattle ranchers adopted five major strategies. They were a) purchased hay, b) purchased concentrates, c) reduced herd, d) increased leases of range and cropland, and e) made no change because of the drought condition.

A survey was made of the area and 41 ranchers were interviewed. The population was restricted to cattle ranchers having from 100 to 300 head, inclusive, of grazing permits with the Bureau of Land Management. Usable records (33) consisted of 23 percent of the estimated population. Representative ranch budgets were constructed for each drought strategy. Coefficients of limiting resources (forage, capital, and grazing permit) were calculated. Estimates were made of both the amounts of products produced and net ranch incomes when each group of ranchers adopted each of the alternative drought strategies. Using 1953 as a norm, drought effects in terms of changes in the value of production per unit of resource used were divided into quantity changes and price changes. The final procedure was to estimate and compare the effects of a moderate and a severe drought on the average net range income of cattle ranches in eastern Oregon.

Decreased production from 1953 to 1955 occurred in all budgets except that of the lease increasing strategy. Cash sales increased except in the hay purchasing group. Ranchers in most cases decreased their inventories of feed

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and livestock. Cash expenses also increased moderately, with the exception of the no change group. This group held their 1955 expenses almost at the 1953 level. The decrease in production from 1953 to 1955 was caused by lower calf crop percentages, generally lower marketing weights, and low hay crop yields. Four of the five groups of ranchers decreased the rate of grazing, but fed hays, grains, and/or concentrates at heavier rates.

The best alternative drought strategy in terms of net ranch income for all groups of ranches was the lease increasing alternative. Adoption of the hay purchasing alternative increased income for two groups - the concentrate purchasing solution and the herd reducing solution.

Changes in the value of production per unit of resources used occur during drought because of changes in both quantities produced and prices paid and received. Most of the decrease in physical efficiency was caused by changes in quantities produced (81 percent). Price changes accounted for a decrease of five to seven cents for each dollar of resource used, with one exception. The concentrate purchasing group participated in the 1955 Federal drought program. For them the change in production per unit of resources used because of price effects alone was nil.

The drought in eastern Oregon in 1954-55 was moderate. Had the drought been severe, estimated average net ranch income would have fallen from the 1953 level of $5,500 to a loss of $370. This compares with the moderate drought level in 1955 of $2,900.

The implications of this study are that attempts to increase the feed supply are more satisfactory than reducing the size of breeding herd. Increased leasing is a better alternative, when available, than hay or concentrate purchasing. Costs are difficult to reduce during drought periods. The key difference in eastern Oregon between financial success or failure during drought is maintenance of the feed supply. 180 pages. $2.35. Mic 58-4001

COOPERATIVE AGRICULTURAL CREDIT IN THAILAND

(Publication No. 23,140)

Udhis Narkswasdi, Ph.D.
Cornell University, 1957

Thailand is a small country of about 220,000 square miles in area. The population is about 20 million people. The majority of people are engaged in agriculture. When Thailand entered a new phase of trade with foreigh countries during the 18th century, the economic status of farmers was much affected. They need credit to finance their farms in order to produce more for commercial purpose. This led to the establishment of the first credit cooperative society in Thailand in 1916 along "Raiffeisen" line. The purposes of this credit society were mainly to assist farmers in the elimination of indebtedness, and to promote thrift, mutual help, and self-help. Since then the credit cooperatives have gradually spread over the country. Most loanable funds of these cooperatives were obtained from outside sources. Therefore, in practice, two serious problems arose, namely: the lack of prompt service and inadequate financing.

The Bank for Cooperatives was set up in 1947 to solve these two problems. The Bank could supply more funds with lower interest rates to cooperatives. However, the Bank itself obtained most of its funds from outside sources. These sources of funds have been drying up and inadequate financing has again become a serious problem. Also the centralization of work has made it impossible for the Bank to make loans promptly.

Two District Central banks were set up on an experimental basis in 1951 and 1952. The main purpose of District Banks is to secure funds from localities in the form of deposits and make loans directly to society-members. It is hoped that the District Banks will be able to raise their owned capital in the form of deposits so that the adequate financing and more prompt service can be obtained.

In the first few years of the operation of these two District Banks, they have proven themselves successful in raising their owned capital in the form of deposits. It is recommended that similar District Banks should be set up in other suitable regions and finally that they should be crowned by an Apex Bank as a Federation of District Banks of Thailand. This Apex Bank will act as the central financial institution for all District Banks. This might be done by converting the existing Bank for Cooperatives into such a Federation. Thus the line of development of credit cooperatives in Thailand would be in 3 stages: as follows: (1) Individual farmers would become members of local credit societies, (2) local credit societies would become members of District Banks, and (3) the District Banks would be the members of the Federal Bank.

To raise the amount of net worth in the District Banks and to collect the saving in the form of share capital, it is recommended that all credit societies be recognized as societies with share capital. This should be done by requiring each member of a local credit society to buy at least one share of 50 bahts in his society, plus one share for every 1,000 bahts borrowed by him. The society, in turn, should buy equivalent shares in the District Bank.

Credit Cooperatives in Thailand now deal in both short term and long term credit. It is believed to be unsound to combine both credit terms in one and the same institution. It is recommended that long term loans should be made on mortgages by separate lending institutions.

State help is considered necessary in the development of cooperatives in Thailand. However, it is suggested that it should be given in such a manner that it will stimulate and foster self-help.

It has been recommended by some cooperative specialists that the multi-purpose cooperatives should be developed in Thailand. This would be done by enlarging the functions of credit cooperatives to supply its members with the other requirements such as seeds, and implements and in marketing of produce. However, this type of organization appears to be unsuitable for Thailand. It is risky to combine credit with other functions. The areas of interest and efficiency differ for different purposes. Also the interests of various purposes are often conflicting with each other. It might result in the performing of a bewildering variety of incompatible functions. The failure in one function would lead to the failure in others. Furthermore, the additional functions may involve more capital than the farmers can afford to contribute. It would lead to a change from unlimited to limited liability in local societies with a view to expanding business. At this stage it would appear to be a very serious development because

unlimited liability is the most important factor in keeping credit cooperatives out of difficulty. It is recommended that more specialized purchasing and marketing cooperatives be developed instead of expanding the functions of local credit societies. 172 pages. $2.25. Mic 58-4002

ECONOMICS OF INCREASED HAY PRODUCTION BY USE OF NITROGEN FERTILIZER ON MOUNTAIN MEADOWS IN THE HARNEY BASIN OREGON

(Publication No. 24,645)

Michael Nelson, Ph.D.
Oregon State College, 1957

Major Professor: E. N. Castle

Cattlemen in desert areas of eastern Oregon have been concerned by the policy of the Bureau of Land Management to delay turnout dates on range, and an apparent decline in hay yields from meadows. Reflecting this concern the Squaw Butte-Harney Experiment Station conducted trials to test the effect of fertilizer on yield and quality of hay and regrowth forage.

The purpose of this study was to provide an economic interpretation of the experimental fertilizer data. The major questions considered were: (1) What is the optimum economic rate of fertilizer application? (2) How is this rate affected by different resource conditions and situations? (3) How is the rate affected by factor and product price changes? (4) What are the policy implications of increased forage production from meadow land?

The study area comprised the northern half of Harney county. A survey of ranchers was made to gain information on resource situations, production, and problems in the area. This information was used to develop the decision making framework within which a rancher must operate. The fertilizer-yield data were analyzed to provide a hay production function which could be used to estimate forage yields at any level of nitrogen. The estimating equation used was an exponential type with the form $\hat{y} = M(1-R^x)$.

Linear programming was applied to various resource situations to select the optimum level of beef production, the area of meadows to be fertilized for stacked hay, bunched hay and pasture, and the rate at which these should be fertilized. The results showed that under limited range it is profitable to expand beef production by about 25% by use of 40 to 50 pounds of nitrogen per acre on meadows and pasturing some cattle through the summer. This rate of fertilization used in a selected resource situation (750 acres of meadow and 3025 A.U.Ms of range, running a 300 cow herd and selling yearlings) would allow an increase in beef production of about 44,000 pounds, giving an increased return to land, labor and management of approximately $2050. Further if range were unlimited it would be profitable to expand beef production by about 66% by use of 100 pounds of nitrogen per acre to provide the necessary forage from meadows. Resource valuations were also obtained from the analysis. The most significant value obtained was that of range which was estimated at between $4 and $5 per A.U.M.

The policy implications of meadow improvement are only indirectly related to fertilizer. They center on the problem of utilizing the increased meadow production in such a way as to improve range usage. There are two ways in which Federal agencies may direct their policy to obtain a more efficient utilization of resources when meadow production is increased. The first would be to develop range land or provide financial assistance to ranchers for range improvement; the second would be a redistribution of range permits in terms of absolute A.U.M.s and in terms of month to month distribution, based on the new productivity of the meadows.

116 pages. $2.00. Mic 58-4003

AN ANALYSIS OF EGG PRICE REPORTS ORIGINATING IN IMPORTANT NORTH CENTRAL REGION MARKETS

(Publication No. 25,274)

James Robert Roush, Ph.D.
University of Illinois, 1957

With the advent of market integration, no one single terminal market dominates the egg production of a given area as it did in the past. Egg dealers and producers in the North Central Region are not only concerned with the egg price structure in the Chicago market, but must be aware of egg prices in the alternative markets which provide important outlets for regional production.

The objectives of this study were to determine the major central markets for eggs produced in the North Central Region and to analyze the price reports for eggs originating within these markets.

The major markets for North Central egg production were Chicago, New York, Detroit, St. Louis, Cleveland, Cincinnati, and Pittsburgh in the order named. The USDA reported wholesale egg prices in each of these markets. In addition to these Federal reports, a private agency reported prices in the Chicago, New York, and St. Louis markets.

Since the daily range in reported prices is an important factor in determining the value of the report as a basis for establishing transaction prices, a portion of the study was devoted to an analysis of reported price ranges. The average daily range of prices reported by the private agencies in Chicago and New York was much smaller than the range reported by the Federal agencies in the same markets. There was little difference between the price ranges reported by the Federal and private agencies in the St. Louis market.

The range of prices reported by the Federal agency in Chicago and New York was smaller than in the other five markets. The daily range was usually greatest during the summer months and smallest during the winter months. In five of the seven markets, the reported range decreased from 1951 to 1955.

The prices reported by the Federal agency in Chicago, New York, and St. Louis were compared with the prices reported by the private agency in the same market. This analysis was designed to determine the extent to which the prices reported by the private agencies in these markets were being used as a base for pricing wholesale grades of

eggs within the markets. The analysis for the Chicago market indicated a rather stable relationship had developed between the two price reports by 1954 and 1955. The relationship between the Federal and private price reports in New York and St. Louis was much more flexible than the Chicago relationship.

Comparisons were made of wholesale egg prices reported by the Federal agency in Chicago and each of the other markets studied. The highest prices were paid in the Pittsburgh market followed by Cincinnati, New York, Chicago, Cleveland, Detroit, and St. Louis in the order named.

Three seasonal patterns were noted in the relationship between the Chicago egg price and the prices in the other markets studied: 1) The New York price exceeded the Chicago price by the greatest margin during the first two quarters of the year and by the smallest margin during the third quarter. 2) The prices in Cleveland, Detroit, Pittsburgh, and Cincinnati exceeded the Chicago price by the greatest margin during the third quarter. 3) Although the Chicago price normally exceeded the St. Louis price during each quarter of the year, the spread between the prices in the two markets was usually smallest during the fourth quarter.

A comparison of the direction of day to day egg price changes in Chicago and each of the other markets studied revealed that the Chicago price moved most closely with the St. Louis price and least closely with the Detroit and Cincinnati prices. 192 pages. $2.50. Mic 58-4004

AGRICULTURE, ANIMAL CULTURE

FACTORS AFFECTING THE NUTRITIVE VALUE OF DRIED WHEY

(Publication No. 25,224)

Leroy Jack Hanson, Ph.D.
University of Illinois, 1957

Ninety pigs were used in two studies to test the effect of feeding lactase with high levels of dried whey. With a diet containing 35% and 70% dried whey the addition of 0.5% lactase concentrate gave no significant improvement in growth rate or feed efficiency in the weanling pig. In addition, suckling, weanling or finishing pigs fed 35% dried whey failed to exhibit a beneficial response to lactase. A determination of the lactase activity of the duodenal area of the gut indicated an exogenous source of lactase increased the activity. The lactase activity varied indirectly with age, but it was not influenced by dietary lactase or lactose.

Six experiments were conducted with weanling albino rats to study the relationship of mineral to the utilization of dried whey. Rats fed two different sources of dried whey as the source of protein responded differently to the two products. Rats receiving a delactosed product gained 21% slower and 33% less efficiently than rats receiving a regular dried whey product. The addition of the ash fraction of the two whey samples appeared to depress both rate and efficiency of gain. In a study of the relationship between lactose and calcium it was found that rats fed lactose or supplementary calcium exhibited higher bone ash values. A calcium-lactose interrelationship existed for rate and efficiency of gain as well as for percentage of bone ash. As the dietary level of lactose increased the response to calcium decreased. With an 8% protein diet the calcium requirement appeared to be 0.6% with 60% lactose and 0.9% with 0% lactose. Rats fed lactose exhibited higher bone ash values than those receiving cerelose at each of four levels of phosphorous and the highest bone ash values corresponded to the highest rate of gain. With an 8% protein diet the requirement for phosphorous was 0.38% regardless of the level of lactose. Levels of 0.51% phosphorous in the diet resulted in a depression of rate and efficiency of gain. There was no relationship between magnesium and lactose with the levels of magnesium used. The requirement did not appear to be greater than 0.01 mg. per gram of diet.

Three experiments involving 180 two-week old pigs were conducted from 4-6 weeks to determine the value of dried whey at 25 and 50% of the diet. In the first experiment 50% soybean oil meal or soybean oil meal and dried skim milk was fed in the presence or absence of dicalcium phosphate. Dried skim milk improved the gain at the high level of dried whey; whereas, the addition of dicalcium phosphate was without effect. In the second experiment 50% soybean oil meal with and without NaCl, meat and bone scraps, blood flour with and without dried skim milk and casein were tested as supplementary sources of protein at each level of dried whey. Soybean oil meal and meat and bone scraps promoted the most rapid and efficient gains. The omission of NaCl from the soybean oil meal diet appeared to be advantageous at both levels of dried whey. In the third experiment soybean oil meal and meat and bone scraps were fed in the presence of 0%, 0.25% and 0.50% NaCl. Soybean oil meal was superior to meat and bone scraps and the presence of NaCl appeared to depress the rate and efficiency of gain of pigs fed soybean oil meal in the presence of 25% dried whey.

110 pages. $2.00. Mic 58-4005

STUDIES ON THE MECHANISM OF THE ANIMAL GROWTH STIMULATION BY ANTIBIOTICS

(Publication No. 25,246)

Mostafa Safwat Mameesh, Ph.D.
University of Illinois, 1957

The effect of penicillin added to the diet on the dietary thiamine requirement for maximal growth by the rat was determined by means of dose-response curves. It was found that whereas penicillin improved the growth of rats given suboptimal levels of thiamine, it did not significantly alter the requirement on the diet used. For the rats without penicillin the requirement was 1.00 ± 0.03 ug. thiamine /g. diet and for the rats given penicillin it was 0.98 ± 0.14 ug./g. diet.

By the use of C-14-labeled thiamine it was found that the amount of available thiamine supplied by the intestinal microflora in rats given diets either adequate or limiting in thiamine was increased in the presence of penicillin. In the case of the rats which were given the thiamine-limiting

diet the "available microbial thiamine" was estimated at 4 ug. and 1 ug. per day with and without penicillin respectively. While in the rats which were given the adequate diet the values were 6 ug. and 0 ug. per day in the same order.

In the case of rats receiving a suboptimal level of thiamine it was found by in vitro studies that penicillin added to the diet decreased the permeability of the small intestine of the rat to both glucose and xylose. Furthermore, the small intestines of the penicillin supplemented rats showed a decreased capacity for utilizing glucose in vitro and a higher weight-length ratio. None of these effects could be detected when penicillin was added to a thiamine-adequate diet. Ascorbic acid at the level of 5% of the diet exerted an effect similar to that of penicillin on the growth and the small intestines of the rat. Phenylthiodiazolethion sulfhydrate, a compound which contains heterocyclic ring sulfur as well as a free sulfhydryl group did not stimulate the growth of rats ingesting a thiamine-limiting diet.

By the addition of raw hen feces to adequate diets it was possible to produce consistent growth responses from antibiotics in the chick. Under these conditions, several compounds were tested for growth-stimulating activity. Trimethyloctadecyl ammonium stearate (Arquad) had about half the growth-stimulating activity of oxytetracycline in three out of four tests. Various forms of sulfur including free sulfhydryl, disulfide, ring sulfur compounds and copper sulfate were tested and found to be inactive in stimulating chick growth.

From these results it was concluded that in the case of the rat, where the growth-limiting condition was the suboptimal thiamine intake, penicillin stimulated the growth by increasing the amount of extradietary thiamine taken up by the tissues. The non-effect of penicillin on the thiamine requirement of the rat could be explained by the observed decrease in the permeability of the small intestines of the penicillin supplemented rats when thiamine was limiting but not when it was adequate.

In the chick, the results support the disease level theory. The disease was transmitted by way of the feces and chicks thus contaminated consistently respond to antibiotics in clean laboratories. 55 pages. $2.00. Mic 58-4006

CHEMICAL AND NUTRITIVE VALUE CHANGES OF ALFALFA ENSILED WITH HIGH LEVELS OF CORN

(Publication No. 25,308)

James Lawrence Williamson, Ph.D.
University of Illinois, 1957

Chemical analyses were used to evaluate: (1) Alfalfa ensiled in experimental silos with levels of 0, 5, 10, 20, and 40 per cent corn; and (2) Silages from large silos filled with non-preserved alfalfa, alfalfa ensiled with up to 20 per cent corn, oats ensiled with up to 20 per cent corn, and corn silage.

Silages from these large silos were compared in fattening and wintering trials with steer calves. All rations in each trial were equalized in silage-roughage dry matter, total corn, legume hay, and soybean oil meal.

Gross energy and nitrogen content changes during drying for analysis were determined, and the following five methods of determining dry matter were compared: toluene distillation, vacuum drying at 95° Centigrade, and oven drying at 46°, 54°, and 105° Centigrade.

A method of correcting silage analyses for the total weight and dry matter changes during ensiling is proposed. It is felt that the use of these corrected analyses describes the ensiling changes more accurately than does the change in percentage composition of the dry matter that is frequently reported.

No significant differences between methods of determining dry matter were detected in any mixture except for differences between vacuum versus 46° and 54° Centigrade drying in the 10 per cent corn-alfalfa silage.

Significant energy losses during drying were found in all mixtures before ensiling except in non-preserved alfalfa in large silos, and significant drying losses were found in all mixtures from experimental silos after ensiling.

No significant gains or losses of nitrogen during drying were found in any of the mixtures before or after ensiling.

Gross energy determinations made on wet samples before ensiling and on comparable samples after removing from the silos showed a significant loss only in the 40 per cent corn mixture, but correcting the determinations eliminated the significance of this loss.

Determinations on dried samples showed no apparent energy losses, but small significant ensiling losses were found in all silages from experimental silos when using corrected determinations.

The ether extract in all silages increased significantly during ensiling, except for the 40 per cent corn mixture which showed no change. Correcting the determinations did not alter the significance of the results.

Ensiling produced no significant apparent or corrected changes in total nitrogen or crude fiber in any of the silage mixtures. There was one significant change in ash, but this difference disappeared when the determinations were corrected.

The pH of all silages decreased significantly in all mixtures, and pH of the silages from the experimental silos showed a significant linear decrease with increasing corn levels.

Silages in the experimental silos indicated very similar temperatures below 38° Centigrade during most of the first thirty-three days after ensiling.

In feeding trials, the only significant differences indicated between silages were higher gains produced by preserved alfalfa over the oat and corn silages in the fattening trial.

The following conclusions are derived from these results:

1. Dry matter analyses were not significantly affected by determination method.
2. Gross energy analysis of wet samples was more indicative of energy content than analysis of dried samples.
3. Sampling errors indicated that the sampling techniques used should be improved in order to detect small differences in silage constituents.
4. Equal feeding of silage-roughage dry matter and total corn indicated that the alfalfa forage, when preserved with corn, was superior to oat or corn forage.
5. On the basis of these data, ensiling a complete steer ration is feasible and appears to offer a means of producing faster and more economical calf gains.

121 pages. $2.00. Mic 58-4007

AGRICULTURE, PLANT CULTURE

FACTORS AFFECTING THE ACIDIC CONSTITUENTS OF THE TOMATO

(Publication No. 25,189)

Raymond Edward Anderson, Ph.D.
University of Illinois, 1957

Acidity in tomatoes is quite variable and it is known that a number of factors affect the development of acidity in tomatoes. The purpose of this investigation was to evaluate some of these factors that may affect the development of acidity in tomatoes with a view toward the reduction of sampling errors and the improvement of the measurement of differences between strains or treatments.

Data were collected on both field and greenhouse grown tomatoes. Samples of fruit were selected at the turning stage and ripened at 20° C except where temperature studies were involved. Generally the fruit were allowed to ripen 4, 8 or 12 days before analyses were performed. The sample size was varied from one fruit to 8 or 10 fruits per sample. Analyses were made on both whole fruit and on the different parts of the fruit.

In addition to pH and titratable acidity determinations, some determinations of the malic and the combined citric and aconitic acid content in the tomato were made. The method used for their determinations was a modification of an ion exchange technique proposed by Schenker. In the course of separating the organic acids by this method it was learned that the temperature at which the separation was carried out had a very pronounced effect on the area over which the various organic acids emerged from the resin bed. In these analyses, therefore, the separations of the organic acids were made in a controlled temperature chamber maintained at 15° C.

It was found that the variability in pH and titratable acidity of single fruit samples from the same plant was as great, or greater than that of single fruit samples which were selected at random from a large number of plants. The variability of samples of 8 to 10 fruit was from one half to one third of that which was found for single fruit samples.

Differences in fruit size did not appear to contribute appreciably to the variability of pH or titratable acidity. However, the temperature at which the fruit were ripened did affect the development of acidity. There was a significantly greater amount of acid present in tomatoes held at 15° C than in those held at 20° and although the acid content was higher at 27° than at 20° this difference was not significant. Malic acid was found to decrease with each increase in temperature, but the citrate-aconitate content was found to be higher at both 15 and 30° C than it was at 20° C.

The occurrence of seasonal trends in acidity were not very consistent. In one year the acidity increased as the season advanced while in another it decreased. The level of acidity developed also varied for the different seasons and years. It was noted that the pH did not reflect these changes too closely. For example, over a two year period two field crops had higher pH values than either of the greenhouse crops and at the same time were higher in titratable acidity. Similarly it was found in analyses of the different parts of the fruit that the locular content though highest in titratable acidity and organic acids was frequently also highest in pH as well. Separations of the organic acids did provide a partial explanation for this, for it was found that where a high pH was accompanied by a high titratable acid content there was a proportionally larger concentration of organic acid salts. The salts acting as a buffer effectively increased the pH.

In determinations of the organic acids it was found that with increasing maturity fruit ripened at 20° C decreased in each of the acids. This was in agreement with the data on titratable acids. It was further observed that the malate content of Stokesdale tomatoes accounted for between 13 and 15% of the total acids determined with the balance being due to the citrate-aconitate anions.

Of the total organic acids found in tomato fruits in this investigation approximately one third were found to be present in their salt form. It was suggested that if this relationship were true for other tomato varieties as well that measurements of the pH and titratable acidity alone should provide a reasonably adequate evaluation of the acidic constituents of a new tomato introduction, and that the more lengthy determinations of the organic acids might be more advantageously applied where controlled plant growing environments can be provided.

68 pages. $2.00. Mic 58-4008

SOME PROPERTIES OF VANCOMYCIN IN RELATION TO ITS ABSORPTION AND MOVEMENT IN PLANTS

(Publication No. 25,253)

Prem Prasad Mehta, Ph.D.
University of Illinois, 1957

INTRODUCTION

The first demonstration in 1947 by Anderson and Nienow (1) paved the way towards the use of antibiotics in plants and since then widespread and keen interest has developed in finding suitable antibiotics which may be used as systemics without being phytotoxic. A new antimicrobial agent, was found to be easily amenable to plants without any visible injuries to them. Thus, a search was conducted for the practical implications in its use in seeds, plants, soil and its phytotoxic effect, if any.

DISCUSSION AND RESULTS

The problem of sterilization was achieved by sintered glass filtration with no loss of activity. Vancomycin was found to be heat labile. It was principally active against Gram-positive organisms. A minimum of 0.1 μg/ml concentration was sufficient enough to check the growth of Corynebacterium tritici in vitro. The possibility of soil watering with vancomycin solution seems to be remote because vancomycin, being an amphoteric compound, and highly soluble in water, was deactivated by soil microflora and rapidly adsorbed by the normal black prairie-loam soil. The active material from plant juice extracts was identified by means of paper chromatographic technique and the Rf values were the same as that of the pure compound.

Vancomycin was readily absorbed by both the excised

and unexcised leaves. There was a linear relation between the absorption and concentration of vancomycin. Absorbed vancomycin was found to be deactivated more rapidly in the leaves of tobacco, tomato, and lima bean than cucumber, however, the degradation was related with the amount of its absorption.

Glycerol and other polyhydroxy compounds along with oils and wetting agents failed to increase the absorption of vancomycin in lima bean and tobacco. No significant difference in absorption could be obtained between the upper and lower leaf surfaces under natural conditions. Absorption during night spray was higher than day which may be accounted due to the slow evaporation during night.

Movement of vancomycin was demonstrated by spraying the leaves, injecting stems, dipping cut petioles and leaves. From sprayed leaves vancomycin was transported down the stem to leaves and roots and up the stem to the young leaves in cucumber, lima bean, pepper, tobacco, and tomato. Downward translocation was greater than the upward from the treated leaves. Similarly, greater translocation occurred to the roots than in shoots when vancomycin soaked seeds were germinated. In addition, plants which were continuously atomized with a solution of vancomycin showed leaf absorption and translocation to the roots.

Vancomycin was absorbed through the roots and translocated to the leaves of tobacco, eggplant, pepper, pea, lima bean, tomato, and cucumber and the concentration gradient was from roots to the shoots. However, the concentration gradient was reversed in tobacco after a certain period of absorption. Furthermore, accumulation in the roots of lima bean resulted in an extract of a higher concentration than the treating solution. This was not true with other species of plants tested. These comparisons indicate the range of variation which may be expected when considering the translocation studies of antibiotics in higher plants.

Vancomycin was distributed throughout the plant system in all the plants under test within 3 hours of treatment at 50 μg/ml except in the case of pepper in which it appeared after 6 hours. These results suggest a very fast movement of vancomycin up to the leaves.

Vancomycin was nonphytotoxic to any part of the plant even though a very high concentration of 1 per cent was used either for leaf spray or seed soaking. Germination of seeds was not at all affected in tomato, cucumber, watermelon, pea, lima bean, and pepper. There is a possibility that internally seed-borne as well as surface lodged bacterial plant pathogens could be eradicated by the use of vancomycin.

SUMMARY

Vancomycin was nontoxic to higher plants or seeds, readily absorbed by the plant parts and translocatable in either direction. Similar Rf values of plant juice extracts and pure compound suggested that the antibiotic is unchanged in the plant system.

It has a wide range of antibacterial activity in vitro, is unstable to heat and can be filtered by sintered glass filtration with no loss of activity. It was rapidly deactivated by soil microflora and was adsorbed by black prairie-loam soil.

REFERENCES:

1. Anderson, H. W., and Nienow, I. 1947. Effect of streptomycin in higher plants. Phytopathology. 37: 1.

94 pages. $2.00. Mic 58-4009

STUDIES ON SEPTORIA LEAF BLOTCH OF WHEAT

(Publication No. 24,167)

Ignacio Narvaez Morales, Ph.D.
Purdue University, 1957

Major Professor: Ralph M. Caldwell

Septoria leaf blotch caused by the fungus Septoria tritici Rob. ex Desm. has become one of the major diseases of wheat in the central soft wheat area of the United States. All of the major wheats grown in this area are seriously affected. There is a great need for developing varieties resistant to the disease. The purposes of these studies have been to develop techniques to evaluate resistance of parental varieties in the field and greenhouse, and progenies of breeding programs and to analyze the mode of inheritance of resistance of certain promising parental varieties.

The fungus grew well either on solid agar media or in liquid, shake-culture. Differences in color and type of growth were noted on potato dextrose, malt extract, rice and Fries agar media. Shake-culture proved to be the most effective method of producing large quantities of inoculum for resistant tests in the field or greenhouse. Failure of infection resulted in tests using inoculum produced in nutrient dextrose agar or in nutrient broth shake-culture. Such inoculum consisted almost exclusively of conidia produced by a budding type of growth. Parallel comparisons of inocula produced in Fries, malt extract, and nutrient dextrose shake-cultures showed that highly virulent inocula can be produced in the first two media while almost complete avirulence resulted from growth in the later medium. Conidia produced in this medium appear largely incapable of growth by germ tubes which are essential for infection. Inoculum containing 75,000 conidia per ml. gave more severe infection than those containing 15,000 or 7,500 spores per ml.

Moist chamber incubation at 60° to 70° F. resulted in more satisfactory infection than incubation at 80° F. Following infection, disease development proceeded equally well at 60°, 70° or 80° F.

Four cultures of the pathogen from Indiana, California, Washington, and Tennessee displayed no specialization in pathogenicity when tested for virulence on 16 wheat varieties with varying degrees of resistance or susceptibility.

Inoculation techniques were standardized for both field and greenhouse inoculations to include the use of inoculum consisting of equal parts of eight to twelve day old shake-cultures and water containing 1% of gelatin to enhance spreading and sticking qualities. A rating-scale of resistance, including five classes of reaction ranging from 0 (highly resistant) to 4 (highly susceptible), was devised.

A group of 640 winter wheat varieties were tested for Septoria leaf blotch reaction in the field under artificial

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

inoculation. A total of 42 varieties were classified as very resistant and 98 varieties as resistant.

A study was made of association of disease reaction and time of heading for the winter wheat varieties tested. The chi-square test of independence indicated that among these varieties earliness is associated with susceptibility and lateness with resistance. The prevalence of favorable weather conditions for Septoria leaf blotch development during the spring of 1955, made possible an evaluation of disease resistance of a group of 237 entries of spring wheat varieties under natural infection. Seven entries were classified as very resistant and 20 varieties as resistant. The field reactions to the disease were found to correlate closely with the reactions under artificial inoculations in the greenhouse.

Studies were made of the inheritance to leaf blotch in the resistant, winter variety Nabob and the resistant, spring varieties Lerma 50 and P_{14}. In crosses of Nabob with the susceptible varieties Knox and Vermillion, greenhouse studies indicated that resistance was governed by two independent genes lacking dominance but with additive effects. In the cross Vermillion x Nabob, awnedness, coleoptile color and resistance to leaf blotch were independently inherited. In crosses of Lerma 50 (resistant) x both Lee and Mayo 54 (susceptible), resistance was governed by a single, completely dominant gene. A similar type of inheritance was found in the cross P_{14} (resistant) x Lee (susceptible). 117 pages. $2.00. Mic 58-4010

THE EFFECT OF SUB-FREEZING TEMPERATURES ON THE VIABILITY AND PATHOGENICITY OF THE FIRE BLIGHT PATHOGEN, ERWINIA AMYLOVORA (BURRILL) WINSLOW ET AL.

(Publication No. 25,271)

Jack Fisk Reinhardt, Ph.D.
University of Illinois, 1957

This study was conducted to obtain data for evaluation of the validity of the observation that the blossom blight phase of fire blight is reduced in orchards which have been subjected to freezing temperatures within 10-12 days prior to blossoming.

As a preliminary test, a fresh isolate of E. amylovora was frozen on PDA and Emerson agar slants at -5 C. for periods of 1, 2 and 3 hours. Results of inoculations into young Jonathan apple shoots with bacteria from these slants when compared with inoculations from nonfrozen slant cultures showed that the cold temperature did not increase the incubation time for symptom development or decrease the number of shoots which blighted.

To further study the effect of freezing, bacteria suspended in a buffer medium were exposed to -4.5 C. Due to the phenomenon of supercooling it was necessary to seed the tubes with a sterile ice crystal to induce freezing. Thus, the experiment was divided into 2 parts by using both frozen and supercooled tubes. Viable counts and pathogenicity tests were made from both sets of tubes at the following day-intervals: 1, 3, 7, 14, 28, 42. Death curves showed that the death rate was much more rapid in the frozen than the supercooled tubes during the first 24-hour period. After this period the bacteria in the frozen tubes died at a much slower rate than those which were supercooled. Inoculations of young Jonathan apple tree shoots did not show a decrease in pathogenicity due to freezing or supercooling.

Designating the normal concentration of E. amylovora which grew during a 24-hour period as X, the effect of 1 week of freezing and supercooling was studied on the following concentrations: 10X, X, $\frac{X}{10}$, $\frac{X}{10^3}$, $\frac{X}{10^5}$. The concentration of the bacteria was found to effect the survival. There was a direct relationship between survival percentage and concentration, regardless of whether the bacteria were frozen or supercooled.

Tetrazolium chloride, lithium chloride, and eosin methylene blue agar have been reported as useful as indicators of pathogenicity. Thus, frozen, supercooled, and check bacteria were cultured on separate agar plates of each of these materials. Different colony formations occurred because of the medium but no differences occurred due to the cold treatments. Red, white, and pink colonies formed on the tetrazolium chloride agar, but inoculations into Jonathan apple shoots from these different colored colonies failed to show any differences in pathogenicity.

Repeated freezings were found to be more lethal to E. amylovora than a single freezing.

Repeated subculturing of E. amylovora in yeast extract broth under aerobic and anaerobic conditions decreased the pathogenicity of the organism with the greatest decrease resulting from aerobic growth. The anaerobically grown bacteria were the most susceptible to death by freezing.

The use of different suspending media indicated that apple juice and bacterial ooze offered some protection against death by freezing when compared with suspensions in phosphate buffer and distilled water. The highest percentage of death occurred in distilled water.

No visible differences were apparent between frozen and non-frozen suspensions of E. amylovora which were shadow cast and observed with the electron microscope.

The number of viable bacteria in the inoculum determined the percentage of inoculated shoots which blighted as well as the incubation time. There was an inverse relationship between cell concentration and incubation time.

Various experiments showed that E. amylovora was sensitive to the effects of freezing. The degree of sensitivity was found to be dependent upon the conditions under which the bacteria were frozen. Thus it is quite likely that a spring frost materially reduces the potential inoculum which exists in the form of bacterial ooze on holdover cankers. This reduction in inoculum may than be evidenced by a light or nonexistent blossom blight phase of the disease. 104 pages. $2.00. Mic 58-4011

A STUDY OF THE INFLUENCE OF BETA-NAPHTHOXYACETIC ACID AND SOIL MOISTURE UPON THE YIELD, BERRY WEIGHT AND CHEMICAL COMPOSITION OF STRAWBERRY FRUITS (FRAGARIA SP.)

(Publication No. 25,316)

Chester Charles Zych, Ph.D.
University of Illinois, 1957

Two experiments were conducted to determine the effects of sprays of beta-naphthoxyacetic acid (NOA) upon developing strawberry fruits. In a replicated field experiment, the effects of NOA upon yield, average berry weight, and chemical composition of Howard 17(Premier) and Vermilion strawberries were determined. In a greenhouse investigation, the response to NOA sprays of Tennessee Shipper strawberries grown with high and low soil moisture availability was determined. The field experiment was done during the 1956 season and the greenhouse study during the winter and spring of 1957.

Two and three drench sprays of NOA, at concentrations of 50 and 100 ppm, were applied to the entire plants in the field during the blossoming and fruit development period. Quantitative determinations of yield and average berry weight were made during the harvest period. Samples of the fruit were taken from early, midseason, and late pickings and stored at approximately -40°C. until chemical analyses were made. Hydrogen-ion concentration, and percentages of titratable acidity and soluble solids were determined on the expressed juice. Percentages of reducing sugars, sucrose, and total sugars were determined on the entire fruit.

Total yields of both Howard 17(Premier) and Vermilion were increased significantly with applications of NOA at 50 ppm and decreased significantly with applications at 100 ppm. Similarly, average berry weight usually was increased by applications of 50 ppm of NOA and decreased by applications of 100 ppm. Vermilion showed larger increases and smaller decreases than Howard 17(Premier) in yield and berry weight.

Spray applications of NOA did not significantly alter the concentrations of the chemical constituents determined. Vermilion was lower in hydrogen-ion concentration and percentage of acids, and higher in percentages of soluble solids, reducing sugars, sucrose, and total sugars than Howard 17(Premier) for all three sampling dates.

Six drench sprays of NOA (four at 50 ppm followed by two at 100 ppm) were applied to Tennessee Shipper strawberries in the greenhouse at two-day intervals, beginning approximately 12 days after anthesis of the primary flowers. High and low moisture treatments were included in a factorial design. All flowers that opened before the first spray was applied were hand pollinated and tagged. Measurements of longitudinal and equatorial axes of 54 fruits per treatment were made at four-day intervals and recorded as fruit-size increments. The weights of measured berries at maturity and of all berries showing development of the receptacle at the termination of the experiment were determined. Number of days from anthesis to fruit maturity was also recorded for each measured berry.

No significant differences attributable to NOA applications were found for fruit-size increment, weight of measured berries at maturity, weight of mature and immature fruit, or number of days to maturity.

Fruits from the high moisture treatments showed a greater fruit-size increment and weighed more at maturity than those from the low moisture treatments. The total weight of all fruit obtained from each plant was also greater from the high moisture treatments.

116 pages. $2.00. Mic 58-4012

A HISTO-PHYSIOLOGICAL ANALYSIS OF THE PREGANGLIONIC CONNECTIONS OF THE CERVICAL SYMPATHETIC GANGLIA

(Publication No. 25,122)

James Lawrence Hall, Ph.D.
St. Louis University, 1957

The postganglionic branches of the superior cervical ganglion innervate many of the blood vessels, smooth muscles and glands in the cranial region (Billingsley and Ranson 1918b), but knowledge concerning the relationships of the preganglionic nerve fibers which synapse in this, and in the other cervical ganglia, is incomplete. Particularly, the relative contributions of the various thoracic spinal cord segments and nerve roots are not well established.

By electrical stimulation of the ventral roots of isolated spinal cord segments and study of resultant effects in the various cervical ganglia in the cat we have attempted to demonstrate the presence or absence of functional relationships between the two areas.

The observed effects of stimulation in the ganglia are undoubtedly significant as indicators of metabolic activity. Various authors have reported changes in the size, shape and staining characteristics of neurones following stimulation. Hodge (1892, 1894), Vas (1892), Lambert (1893), Mann (1894), Nissl (1896), Peck (1898) and others have reported cellular enlargement with an increase in nuclear-cytoplasmic ratio, chromidial dispersion, and proliferation of neuroglial cell nuclei. While the results of these investigations are not in total accord, it is important to remember that the experimental conditions have varied with reference to the type of stimulation used, the type of nerve cells studied, the methods of tissue fixation and sectioning, and the staining procedures employed.

Our control and experimental tissues were sectioned and stained with the toluidine blue method of Richins and Hall (1957) and the gallocyaninchrome alum technique of Einarson (1932). Altered staining reactions and

morphological changes consequent to electrical stimulation were observed. Control and experimental tissues were fixed together in 4% aqueous lead subacetate, and sections from both were mounted on the same slides for staining.

Stimulation of the distal end of the severed cervical sympathetic trunk for three hours with an Electrodyne stimulator at 10 volts and a frequency of 20 per second always produced changes in the neurones of the superior cervical ganglion. With toluidine blue and neurones stained green after stimulation, as contrasted with the blue color of the controls; and chromidial dispersion was demonstrated by the gallocyanin-chrome alum method.

The nervous basis of these reactions was signified by the fact that autonomic drugs could be used to alter the responses. Intravenous injection of ergotoxine ethanesulphonate presented the reactions from occurring. The use of atropine sulfate and hexamethonium bromide produced a strong metachromasia, and the glial elements stained pale blue with toluidine blue rather than the normal yellowish-green.

Stimulation of isolated ventral thoracic nerve roots one through three produced the same effects in the superior cervical ganglion as did stimulation of the cervical sympathetic trunk. Stimulation of the eighth cervical and the fourth to eighth thoracic ventral nerve roots, however, failed to elicit these changes. The techniques employed demonstrated no changes in the stellate ganglion following stimulation of any of these roots. The middle and intermediate cervical ganglia are not consistently present in the cat, and could not be properly studied.

Our results seem to indicate that the first three thoracic segments of the spinal cord give origin to the preganglionic nerve fibers which pass to the superior cervical ganglion. The absence of responses in the stellate ganglion may indicate that the synaptic connections are too scarce to be affected by the techniques employed or that the outflow follows a pathway yet to be demonstrated. It is unlikely, however, that this would be found at a spinal level caudal to those stimulated.

43 pages. $2.00. Mic 58-4013

A MARCHI STUDY OF THE CONNECTIONS OF THE THALAMUS IN THE MONKEY[1]

(Publication No. 24,912)

Edward Paul Maibenco, Ph.D.
Northwestern University, 1957

A thorough comprehension of the connections of the thalamus is the key to an understanding of the cortex, for organization and integration of various motor and sensory systems is believed to take place at this level. The few studies of degenerated fibers, as a result of direct thalamic lesions, are at varience with the retrograde cell degeneration studies. A thorough study of thalamic connections has been undertaken, using the Marchi method to stain degenerated fibers resulting from direct thalamic lesions.

A set of frozen, serial sections of a complete standard monkey brain was made for a new type of stereotactic instrument, that is based on the duplicator principle; and slides, rather than an atlas, are used as a reference point for the accurate placement of lesions. This instrument has a great range of movement, and the range of direction of the electrode is practically unlimited. The change of angle is accomplished with no difficulty, and requires no previous calculation. Data from operations were used to verify the instrument, and correction factors have been obtained so that lesions can be placed quite accurately in a previously determined locus.

Lesions were placed in the brains of fifteen monkeys. The animals were sacrificed after survival of two to four weeks. The brains were removed, stained by the Marchi method, serially mounted, and the degenerated fiber connections were studied.

A lesion to nucleus medialis confirms the previous observation of connections to prefrontal cortical areas 46, 8, 9, 10, and 11 in the inferior frontal gyrus, medially to the medial orbital gyrus. No statement can be made concerning the topography of the projection of this nucleus, since the lesion was limited to the ventral half. The well established projection of the lateral geniculate body was traced to the striate occipital area, and confirms the finding of Poliak. Nucleus VPI was observed to have two projections; a projection of fine fibers and a projection of coarse fibers. The fine fibers remain ventral to and separate from the coarse fibers. They gather ventrally in internal capsule and project anteriorly to areas 6, 8, and 44. Few of ventral-most, coarse fibers cross the internal capsule to enter globus pallidus. The vast majority of coarse fibers swing dorsally through the internal capsule to terminate in area 4 of the paracentral lobule and in the precentral gyrus as far ventrally as the precentral notch. Lesions in LA produced degeneration in fibers going to areas 6 and 8 of the frontal cortex. The fibers to area 8 were found to be collaterals of the main fiber projecting to the dorsal part of area 6. No degenerated fiber projections were able to be traced from lesions to the centralis, VA, LP, and medial pulvinar nuclei.

Besides showing the origin and termination of some thalamic projections, the courses of these fibers have been illustrated in reconstructions of standard 4 mm. slices of brain. The paths of the thalamocortical fibers through the internal capsule were found to be quite different from those of corticifugal fibers.

There was found a minimal degeneration time of four weeks for the projection of nucleus medialis to show by the Marchi method. This agrees with studies which show a definite time specificity for degeneration of various projecting systems. No intrathalamic connections were found in this study. This was hoped to be an important aspect of this study. These shorter connections are thought to be unmyelinated, and so they would be studied advantageously by some other degeneration stain technique.

126 pages. $2.00. Mic 58-4014

1. Supported by grants from U. S. Public Health Service.

ANTHROPOLOGY

CASTE, CLASS AND FAMILY IN AN INDUSTRIAL COMMUNITY OF NORTHERN INDIA

(Publication No. 25,151)

Arthur Neihoff, Ph.D.
Columbia University, 1957

This paper is a study of social change in a community of industrial laborers living in Kanpur, Uttar Pradesh, India in 1953-54. The research was accomplished by means of a year's residence among the workers in Kanpur. The major socio-religious groups that were found in the factories, Hindu, Moslem and Sikh, are represented in the study. The purpose of the study is twofold: first, to make a comparative analysis with changes in the West that have resulted from urbanization and industrialization, and second, to assess any changes that are uniquely Indian.

Industry in Kanpur has a history of about 90 years. Leather working and textiles are the main industries. The factories were originally started by the British and the social organization of the Indian village community was not taken into account. Laborers were hired as they applied. As a result, until World War II the labor force was made up almost entirely of Moslems and low caste Hindus. Since the late 1930's the middle and high caste Hindus have been entering the factories in greater numbers than the other two groups. The middle and high caste Hindus will now work in a leather factory though they will not handle unprocessed hides. In general, however, the middle and high caste Hindus are more limited than Moslems and low caste Hindus in job opportunities because of pollution taboos.

Inter-caste relationships are encouraged by three factors among these workers. First, men of different caste work side by side in the factories; second, housing conditions are crowded, compelling men of different caste to live next to one another; and third, the city provides a cloak of anonymity for those who wish to ignore caste rules.

The low castes show the greatest amount of change in this new environment. While the high caste Hindus follow a policy of nonaggressive aloofness, the men of low caste have become vociferous in their demands for equal treatment. This differential is probably due to the changed economic circumstances of the factory worker. All castes have the same employment opportunities. The high caste man has no economic need for the low caste man as he does in the village relationship. The low caste man on the other hand is experiencing a freedom in social relations that was unknown to him in the village.

The factory worker coming from the village to the city becomes a part of a class system which is quite distinct from his caste position. His social contacts are restricted quite as much, and perhaps more, by his class position as by his caste position. The difference between the two systems is basically as follows: caste position depends on hereditary status, sanctioned by Hinduism, in which pollution and eating taboos increase in moving upward; class position depends on economic status, reflects western influence, and in which pollution and eating taboos decrease in moving upward in the hierarchy. Almost all factory laborers are of the lowest class status though they can be of any caste. It could easily be argued that the increase in mobility due to the weakening of caste mores in the city has almost been negated by the very rigid class system the worker has been fitted into.

The nuclear family has become the predominant household unit among these workers. Marriage age is relatively late and the high castes are hindered most in this respect because of their higher dowries. Family size is smaller than the national average, probably because the marriage age is relatively late.

184 pages. $2.40. Mic 58-4015

BACTERIOLOGY

EFFECT OF ENVIRONMENTAL FACTORS UPON A STAPHYLOCOCCUS HOST-PHAGE SYSTEM

(Publication No. 25,368)

Joan Lucia Countryman, Ph.D.
Stanford University, 1957

The effects of some nutritional factors on the K staphylococcus (Micrococcus pyogenes var. aureus) and its production of the K bacteriophage were investigated, and an attempt was made to determine specific nutritional substances required for phage production by this system.

The influence of the growth history of the culture and of culture age on the ability of the host to support phage production were also studied.

Under a variety of conditions, determinations were made of growth of the organism or phage production, or both, in nutrient broth, in a synthetic medium, or in a synthetic medium to which additions of other known substances were made.

Growth of the K staphylococcus was measured by optical density readings or by colony count. The course of phage production was followed by the one-step growth technique of Delbruck and Luria (Arch. Biochem., 1:111,

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

1942) or by a modified technique in which phage production by infected cells was measured after they were washed and resuspended in various media.

No synthetic medium could equal nutrient broth in supporting growth or phage production. The K bacteriophage in nutrient broth had a latent period of 30-32 minutes and an average burst size of 40-50 particles.

Cells grown in nutrient broth upon transfer to a synthetic medium required substances for phage production which could not be determined by addition of any known substance to the medium. An unknown factor in yeast extract, however, did support phage production when added to the medium. Maximum phage production was obtained only when the cells were resuspended in nutrient broth. It was necessary that the substance(s) in broth be present in the supporting medium until very late in the latent period.

Cells grown in the synthetic medium were able to support limited phage production early in the course of this study but after several months' subculture could no longer do so. When transferred to nutrient broth and grown for a short period of time they could support some virus production if resuspended in nutrient broth after infection.

Nine purine and pyrimidine analogues were tested for effect upon phage production, growth of the organism, phage adsorption, and stability of the phage in vitro. None was found to exert any effect except dichloropurine, which inhibited phage production to a limited extent when the host cells had grown in the presence of the compound for a time.

The yield of virus from late lag phase, logarithmic phase and late logarithmic phase cells varied, with the youngest cells producing the greatest amount. Cells from the stationary phase or phase of decline could support little or no virus production.

The results and their possible relation to the influence of the physiological condition of the cells on their ability to support phage production are discussed.

83 pages. $2.00. Mic 58-4016

A TEMPERATE BACTERIOPHAGE ASSOCIATED WITH SOME SPECIES OF NODULE BACTERIA

(Publication No. 25,204)

Robert Jaquette Davis, Jr., Ph.D.
University of Illinois, 1957

An investigation was initiated to determine whether the rhizobia (root-nodule bacteria) exhibit the phenomenon of lysogeny. No temperate phages had been reported previously for the rhizobia but their existence seemed most probable.

Stock cultures of rhizobial strains were screened systematically for evidence of lysogenic properties. Several cultures were found to have the ability to lyse other cultures. The lytic factor in one such culture, designated LN120, was isolated and identified as a temperate phage. This phage strain was characterized and found to differ in many respects from other strains of rhizobiophage reported in the literature.

The phage produced plaques on agar plates which slowly increased in size until the entire plate was lysed or the agar dried. All bacterial filters used removed the phage from suspension. The phage was inactivated at low concentrations of chloroform and streptomycin. A temperature of 55° C inactivated the phage completely. At 12° C the phage lost half of its activity each week at low concentrations, but at high concentrations the rate of inactivation was less.

Adsorption of phage to the host cell was found to take place best at approximately pH 8.0 with activity falling off more rapidly on the alkaline side of the optimum range. On the acid side activity tapered off much slower giving essentially two plateaus to the adsorption curve.

The phage needed divalent ions for adsorption, Ca and Mg being equally effective. Concentrations of .05 molar of either of these ions gave better adsorption than .005 molar. Little adsorption took place below .0005 molar concentration. Monovalent ions had little effect either alone or with Ca or Mg.

Burst size of the phage averaged 32 particles and the latent period was between one and two hours. A clear plaque variant of the phage was isolated and studied. It appeared similar to the normal phage strain in all respects except virulence toward certain rhizobial strains.

The host range of the phage was quite wide. It was active against 97 of 108 rhizobial strains from 16 "cross-inoculation" groups, several strains of Agrobacterium radiobacter, several strains of Azotobacter species, six laboratory contaminants (which might have been aberrant rhizobium), and a strain of Pseudomonas fluorescens.

Modification of the genetic material of rhizobial strains through phage mediation was observed. Characteristics checked include infectivity (ability to infect leguminous plants and form nodules), effectiveness (efficiency in symbiotic nitrogen fixation), and fermentation of various carbohydrates. Changes were noted in both effectiveness and fermentation characteristics of some strains after phage passage. The exact manner of this transformation was not ascertained but transduction of genetic material by the phage seems the most obvious explanation.

The phage studied appeared able to lysogenize other rhizobial strains. The extent of lysogenization was dependent upon environmental conditions. Induced phage gave evidence of causing a greater degree of lysogenization than did phage produced via the lytic pathway on a sensitive host strain. 110 pages. $2.00. Mic 58-4017

A STUDY OF PIGMENT PRODUCTION BY SPECIES IN THE GENUS RHODOTORULA

(Publication No. 25,206)

Robert David Deufel, Ph.D.
University of Illinois, 1957

Typical carotenoid pigments have only been encountered in asporogenous yeasts with a strictly oxidative assimilation. The ability to synthesize a number of such pigments has been suggested by Lodder and Van-Rij (5) as a means of distinguishing Rhodotorula from the genera Cryptococcus and Torulopsis. The formation of carotenoids by cultures of Rhodotorula has been reported by several investigators (4) (3) (1). These workers, however, dealt mainly with distribution and characteristics of the pigment, and little emphasis was placed upon the nutritional conditions affecting its production. Recently other investigations (2)

(7) (10) have established a relationship between differences in cultural conditions and variations in kinds and amounts of pigment produced.

This study attempted to find a means of extracting pigment from cells quantitatively, and to adapt chromatographic and spectrophotometric procedures to a determination of the β-carotene fraction. The influence of some nutritional factors was examined in relation to β-carotene synthesis and growth.

MATERIALS AND METHODS

Microbiological. Seven species and one variety, comprising the genus Rhodotorula, were used along with two sub-species. These were cultivated in non-synthetic broth containing glucose, vitamin-free casamino acids, yeast extract and malt extract broth, for 48 hours. High, medium, and low carotene-producing cultures (Rh. flava, Rh. gracilis and Rh. pallida respectively) were grown in synthetic broth containing glucose, $(NH_4)_2SO_4$, salts and vitamins for 72 hours. These were incubated in Fernbach flasks on a reciprocal shaker at 26°C.

Chemical and Analytical. The cells were treated by mild acid hydrolysis using 0.5N HCl suggested by Peterson et al (9). The carotenoids were extracted with acetone and transferred into hexane. Purification was achieved by shaking with aqueous and methanolic alkali solutions. Chromatographic separation of β-carotene followed the procedure of McCollum (6), employing adsorption columns packed with magnesia and filter aid mixed 1:1 and eluting with 3 drops of absolute ethanol. Determinations of β-carotene were made at 436 mμ using the Beckman DU Spectrophotometer according to A.O.A.C. (8).

RESULTS AND DISCUSSION

The β-carotene content ranged from 5.2-120.8 μg. per gram of dry cells among the ten cultures grown in non-synthetic medium. The acidic pigment torularhodin was absent in four cultures and doubtful in two others. Two types of chromatographic behavior were observed, indicating that the acid hydrolysis probably led to some isomerization of β-carotene.

Growth and synthesis of β-carotene corresponded closely during the logarithmic phase. The production of β-carotene was initiated after 24-36 hours in non-synthetic medium and after 36 hours in synthetic broth. Yields of carotene were 25-50% less in synthetic medium. Carotene formation decreased in the first part of the stationary phase, but resumed at a rate nearly comparable to the original after 96 hours.

Various carbon sources affected growth and carotene formation to different extents. None of the compounds tested permitted β-carotene production as high as glucose. Also no nitrogen source equalled $(NH_4)_2SO_4$, in its influence on carotene synthesis with glucose as a carbon base. Only Rh. pallida varied from this pattern. Organic nitrogen affected the utilization of poorly assimilated carbon compounds as measured by increased amounts of carotene. Increased growth without increased carotene production suggested the low C:N ratio was limiting, carbon units being diverted to protein synthesis. Evidence was also found for the stimulation of carotene synthesis by thiamine in those yeasts which require it.

SUMMARY

Methods for extracting pigments from Rhodotorula and the determination of β-carotene are discussed. Evidence for carotene synthesis as a function of growth, nutrition and C:N ratio is reported.

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201 pages. $2.65. Mic 58-4018

AZOTOBACTER BACTERIOPHAGE

(Publication No. 25,165)

Douglas Sheldon Kellogg, Jr., Ph.D.
The University of Texas, 1957

Supervising Professor: Dr. Orville Wyss

A study has been made of a bacteriophage effective upon the azotobacter and the consequences of infection with this phage upon the metabolism of the azotobacter cells.

A semi-quantitative survey of diverse soil types of central Texas indicated the level and distribution of the phage. Studies of the effects of medium constituents showed that several factors such as temperature; amount of medium; percentage of agar in the soft agar pour layer; the age, number and previous history of the indicator cells were important in obtaining consistent and reproducible plaque formation. A level of medium constituents which gave the most rapid and most volume of cell growth also gave the best results with the phage. In the absence of a carbohydrate source there was no replication of the phage. The replication of the phage was very sensitive to alterations of the pH even when these alterations did not have an appreciable effect upon the cell growth. No alterations of plaque morphology were obtained as a result of the additions of inorganic or organic nitrogen sources.

The percentage adsorption of the phage-cell system which was studied most extensively was 76 per cent and the adsorption was rather weak. Levels of log nine per

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milliliter of phage were obtained in broth routinely if periods of quiescence were allowed for the adsorption of the phage. Complete clearing of broth was never obtained and the resultant secondary growth was not found to be of altered sensitivity to the phage. True perpetuating mutants of the phage have never been observed and it has not been possible to detect the presence of lysogeny in any of the strains of azotobacter in our stock. The host range was confined with one exception to the A. vinelandii strains of azotobacter.

The latent period of 150 minutes was not altered by pH or washing of the cells, whereas the rise period was very sensitive to the effect of pH. Divalent cations were required for the adsorption of the phage to the cells at approximately the same levels as required by other phage-cell systems. Infection of the cells with the phage did not result in an alteration of their oxygen uptake until lysis occurred. The cells were capable of replicating phage while adapting to the utilization of nitrate and replicated phage more rapidly on nitrate medium than when growing on nitrogen-free medium.

The phage was quite stable in nitrogen-free lysates at four degrees centigrade for at least a year. Clarification of the phage lysates by several procedures was found to enhance the sensitivity of the phage to inactivation. Sonification of the phage revealed that it was considerably more sensitive than the T-series of coliphages and the Bacillus megaterium M-phages. The use of low centrifugal forces for relatively long periods of time and slow resuspension of phage pellets allowed the recovery of 87 per cent of the total phage. Using a sponge electrophoresis apparatus, the phage at all pHs tested moved as a single peak to the anode and at a constant rate from pHs 6.0 to 8.0. Electron photomicrographs of the phage demonstrated that it was a very large phage and of the same general morphology as the even numbered members of the T-series of coliphages.

102 pages. $2.00. Mic 58-4019

EXPERIMENTS WITH MUTANTS OF ESCHERICHIA COLI STRAIN B WHICH ARE BLOCKED IN METHIONINE BIOSYNTHESIS

(Publication No. 25,167)

Lloyd Stanton Lockingen, Ph.D.
The University of Texas, 1957

Supervisor: Professor Wilson S. Stone

Mutants of E. coli B were classified into three groups according to their ability to use vitamin B_{12}, methionine or homocysteine. Mutants requiring methionine could not substitute combinations of homocysteine with S-methyl cysteine, dimethyl-β-propiothetin or methylsulfonium methionine iodide, indicating a general unavailability of the labile methyl groups of these compounds for methionine synthesis. All of these mutants could use methionine sulfoxide to replace methionine indicating that a salvage mechanism apart from the normal biosynthetic pathway was present in this organism.

By starvation in glucose minimal medium of two methionine requiring mutants, one of which grows with vitamin B_{12}, it was possible to show that vitamin B_{12} does have a function in methionine synthesis in both mutants with respect to bacteriophage production. No relationship between B_{12} and deoxyribosides could be detected by these methods.

Starvation of mutants requiring B_{12} or methionine in lactate medium causes a loss of capacity to produce phage that is not related directly to the mutation since neither methionine nor B_{12} relieves the deficiency produced by starvation, however yeast extract or peptone does increase the capacity of these mutants to produce phage.

Methionine sulfone and methionine sulfoximine do not promote the growth of mutants blocked in methionine biosynthesis when incubated in minimal media. Both compounds are growth inhibitors of E. coli B and produce an inhibition which is partially reversed by glutamic acid, glutamine, methionine and methionine sulfoxide.

83 pages. $2.00. Mic 58-4020

STUDIES ON THE RADIATION RESPONSE OF ESCHERICHIA COLI AND BACILLUS CEREUS

(Publication No. 25,177)

William Robert Romig, Ph.D.
The University of Texas, 1957

Supervisor: Dr. Orville Wyss

Synchronous cell division in Escherichia coli has been induced by temperature conditioning, inhibition with sulfanilamide, and during the lag period of induced enzyme synthesis. The first method was found superior for use in the investigation of the radiation response of the cells thus phased. It was concluded that successful synchronization of bacterial cultures by other than physical separation probably results from a selective inhibition of nuclear syntheses.

The ultraviolet sensitivity of synchronously dividing E. coli B/r was greatest during the period of active multiplication and lowest during the growth phase preceding division.

The incidence of streptomycin-resistant mutants and histidine-independent back mutants was found to be highest during the interdivisional phase.

In endotrophically sporulating cultures of Bacillus cereus the ultraviolet resistance characteristic of mature spores develops prior to the appearance of heat resistance. By cytological studies with a phase microscope it was shown that the ultraviolet resistance of the developing spore may be correlated with the forespore, while the appearance of heat resistance is delayed until formation of the refractile endospore.

The degree of photoreactivability exhibited by sporulating cultures of B. cereus was shown to increase shortly after placing them in distilled water and to disappear at the stage of increased ultraviolet resistance. These changes were correlated with the degree of synthesis of ribonucleic acid by the culture.

It was postulated that the general resistance of spores to deleterious agents is preceded by changes in nucleic acids which protect them from ultraviolet light and also inhibit photoreactivation by visible light. Further metabolic changes, such as the formation of spore coats and

possibly alteration of the spore protein confer resistance to heat, chemical and other deleterious agents.

The interference with the spore forming mechanism by low doses of ultraviolet light and its reversal by white light was demonstrated. The pattern of ultraviolet sensitivity of the spore forming mechanism during sporulation was shown to be compatible with the concept that spore formation in endotrophically sporulating cultures is closely related to the synthesis of induced enzymes in other systems.

134 pages. $2.00. Mic 58-4021

OXIDATIVE ASSIMILATION BY ASPERGILLUS NIGER

(Publication No. 25,394)

Benjamin Reid Tamplin, Ph.D.
Stanford University, 1957

Mycelial pellets of Aspergillus niger, grown from spores in a synthetic medium, were allowed to respire in the presence of glucose in a buffer solution free of combined nitrogen. From the amounts of glucose and oxygen utilized and the amount of carbon dioxide produced, as determined manometrically, the percentage of the glucose assimilated was calculated, attempts being made to correct for the high level of endogenous respiration. When the observed exogenous oxygen consumptions were corrected for those observed in the endogenous controls the results at different glucose concentrations varied from each other to about the same extent as when no correction factor was applied. Manometric data alone, therefore, give little indication regarding the extent of assimilation by the mold.

In some experiments carbohydrate concentrations of mycelium and medium were determined at the beginning of the experiment and again when all of the glucose had been taken up from the medium. The anthrone reagent, which allows a determination of carbohydrate concentration without the necessity of a lengthy hydrolysis, was used. Fractionation of the mycelial carbohydrates based on their solubility and stability when treated with 30 percent potassium hydroxide at the temperature of a boiling water bath was also carried out and the concentration of the various fractions was determined by means of the anthrone reagent.

When carbohydrate concentrations in the mycelium and medium were determined, approximately 50 to 55 percent of the added glucose could be accounted for as cellular carbohydrate. Thirty to 45 percent of the added substrate could be accounted for as carbon dioxide and water and the remaining 15 to 20 percent of the glucose, although not accounted for manometrically or by chemical tests, may represent material stored in other than carbohydrate form or cast off by the cell.

In the first experiment wherein fractionation of the mycelial carbohydrates was attempted a definite concentration increase was noted in the alkali-labile and alkali-insoluble fractions. A slight increase was noted in the alkali-soluble fraction and a slight decrease occurred in the case of the alkali-stable carbohydrate fraction. This experiment was carried out over a four-hour period, at which time assimilation amounted to 77 percent of the added substrate when the sum of the carbohydrate fractions was used as the criterion for assimilation. Under the same conditions at two hours the assimilation amounted to 62 percent. When this type of experiment was carried out over a period of twenty hours once again the alkali-insoluble fraction showed a marked increase. However, in this case, the alkali-stable carbohydrate fraction exhibited an even greater increase than the alkali-insoluble fraction. These results would tend to indicate that the alkali-insoluble fraction is more rapidly synthesized than the alkali-soluble fraction and that relatively little glycogen or trehalose is formed since they would appear in the alkali-soluble fraction of the carbohydrate.

67 pages. $2.00. Mic 58-4022

STUDIES ON THE VI ANTIGEN

(Publication No. 23,458)

John Emilio Verna, Ph.D.
Brown University, 1957

The Vi antigen content of saline extracts prepared from fresh moist and acetone dried cells of three bacterial species at various temperatures and time was determined by a new hemagglutination test. Extracts of fresh cells were found to increase in Vi antigen concentration with an increase in temperature from 22 C to 100 C but decreased in Vi antigen content from 100 C to 121 C. This decrease in Vi antigen was taken to be thermal destruction. Extracts of acetone dried organisms prepared at the same temperatures (22 C, 100 C and 121 C) contained equally high concentrations of Vi antigen. Acetone dried organisms suspended in saline for merely ten minutes were found to yield equally high concentrations of Vi antigen at room temperature. Factors which influence the extent of Vi antigen dissociation from the cells were found to be cellular content, time and temperature. Consecutive one hour extractions at room temperature showed continued dissociation of Vi antigen for nine extracts.

The thermostability of the Vi antigen in saline extracts was studied at 121 C. The total destruction of the antigen was found to vary with time and initial concentration of the extracts. An undiluted saline extract of Paracolobactrum ballerup was found to resist 121 C for 11 hours while a 1:100 dilution of the same extract was Vi positive up to the eighth hour. Destruction curves for Vi antigen in these two concentrations (undiluted and 1:100) obtained by plotting the log of the Vi n-hemagglutination titers against time heated at 121 C, were similar and exhibited a step-like destruction.

The Vi antigen was not soluble in an alcohol saline mixture when the alcohol concentration exceeded 66.7 percent but was soluble in an alcohol distilled water mixture in which the alcohol concentration was 90 percent or more. The absence of sodium chloride thus plays a role in the Vi antigen solubility in alcohol.

A purified Vi antigen prepared from an unheated alcohol saline mixture was used to impregnate sheep erythrocytes before and after it had been boiled 24 hours in water and in 0.1 N acetic acid. These impregnated erythrocytes were employed in the reciprocal differential adsorption of five Vi antiserums prepared against living Vi positive cultures of Escherichia coli, Paracolobactrum ballerup and three strains of Salmonella typhosa. Hemagglutination

reactions of erythrocytes impregnated with the three Vi antigen preparations demonstrated the presence of two definite fractions of this antigen and a possibility of two more. The absence of a particular fraction of the Vi antigen could not be detected when tested by ordinary hemagglutination in a complete Vi antiserum.

50 pages. $2.00. Mic 58-4023

BIOGRAPHY

CHARLES ELLET JR., EARLY AMERICAN ENGINEER, 1810-1862

(Publication No. 25,240)

Gene Dale Lewis, Ph.D.
University of Illinois, 1957

Charles Ellet Jr. (1810-1862), an eminent American civil engineer, is mainly remembered for his Civil War activities, and especially for his ram fleet on the Mississippi River. His spectacular defeat of the Confederate fleet at Memphis, which resulted in his death, was only the climax to an eventful career.

Ellet was born in Bucks County, Pennsylvania, sixth of the fourteen children of Charles Ellet, a Quaker farmer, and Mary, daughter of Israel Israel, high sheriff of Philadelphia. At seventeen he left home, working as rodman on the Susquehanna survey, then (1828) entering the service of the Chesapeake and Ohio Canal as an assistant in both the field and office. In March, 1830, he made his first of three trips to Europe, to attend the Ecole Polytechnique in Paris. He witnessed the July Revolution, was received by Lafayette, and, travelling by foot, inspected European and English engineering works. In 1844, on his second trip abroad, he kept an elaborate diary of his European impressions, and in 1854-1855, while he was in Europe attempting to secure credit for the Hempfield and the Virginia Central Railroads, he communicated his ideas on the steam battering ram as a weapon of war to both Russia and the Allies, then involved in the Crimean War.

Ellet's main claim to fame is not based on his Civil War record but rests, in the first place, on his recommendation for the prevention of floods and for the improvement of navigation on the western rivers. He was the first person to advocate a comprehensive plan of river improvement basing his recommendations primarily on the utilization of upland reservoirs as a means of impounding surplus waters. His ideas were contained in his magnum opus, The Ohio and Mississippi Rivers, published in 1853. Secondly, his reputation is based on the fact that he introduced the principle of the suspension bridge into America. Building the first permanent suspension bridge in this country in 1842 across the Schuylkill River in Philadelphia, he advocated (unsuccessfully) the construction of a suspension bridge over the Potomac which would have proved of great assistance to the Union forces during the Civil War. He engineered and supervised the construction of the first bridge over the Niagara gorge in 1848, and in 1849 built a suspension bridge, 1,010 feet in length, over the Ohio River at Wheeling, then the world's longest span.

Ellet was a prolific writer. Forty-six published works, as well as numerous technical and popular articles, attest his trenchant style in scientific and controversial writing. His Essay on the Laws of Trade (1839), a recondite treatise on rate-making, was followed by several pioneer contributions to transportation economics. After 1860 articles for American and English periodicals reveal his grasp of wartime problems. As one of the chief critics of McClellan's tactics, he received wide support and attention on numerous occasions when he presented his own plans for crushing the Confederacy. Thoroughly familiar with the geography of Virginia, he had been chief engineer during the construction of the James River and Kanawha Canal, the main internal improvement in Virginia prior to the Civil War. Later as chief engineer for the Virginia Central Railroad he became intimately acquainted with the entire transportation network upon which the Confederate army in Virginia depended.

Ellet's interests ranged from problems involved in bridge building, and canal and railroad construction to the economics of transportation and the improvement of western rivers. Of the many individuals who have contributed significantly to the advancement of the industrial revolution in America, few have contributed more in both theory and practice than Charles Ellet Jr.

320 pages. $4.10. Mic 58-4024

ROBERT BURNS AND JAMES HOGG: A COMPARISON

(Publication No. 23,645)

Abby A. Sutherland, Ph.D.
University of Pennsylvania, 1957

Supervisor: A. G. Chester

The present study, a comparison of Robert Burns and James Hogg, the Ayrshire Ploughman and the Ettrick Shepherd, aims to show the likeness in environment, heredity and influences of these two Lowland Scottish bards and to compare their work.

The ambition of each, to voice the spirit and tradition of his race and at the same time to win a place of honor for himself in the hearts of his countrymen, was ever paramount to his need to win a livelihood. Both were of humble rustic lineage; both won high place in the esteem of men of literary and social distinction.

The same love of ancient Scottish minstrelsy was deeply ingrained in their spirits by mothers who treasured the traditional songs and ballads, with musical voices for singing them into the hearts of their sons.

Their home language, the Braid Scots, a perfect vehicle for their need, gave to the poems of both a cadence and a simplicity, a freshness of expression and a primitive beauty of style.

As to character, Burns was the soul of truth and integrity, but he wandered from the Covenanter standards of the Church and his saintly father's example, into irregularities of sex and indulgence in ungoverned passion. He was rebuked in open session of the Kirk for his conduct in this respect.

Hogg was regular and conforming in his moral code as to sex; but in truth and integrity and records show several instances of untrustworthy acts and falseness in business relations.

The output of literary material by Hogg was enormous, the quality of which in charm and skill is ordinary and, in some cases, inferior. A few exceptions are of the best of their kind.

The prevailing quality, charm, gives Burns' poems immediate approval and lasting appreciation. The Scottish devotion to his work was immediate, with a clannish enthusiasm about it, which still prevails. In a recent visit to Scotland we were impressed with the warmth of devotion to all the haunts of Burns' memory--farms, home, tomb, Kirk, Kilmarnock, "Auld Reekie," Tarbolton. The guides, the club members all know by heart and sing his songs, recite "Tam O'Shanter," and cling to their dialect for love of his poems.

Hogg's work is growing in popular affection and in favor with modern critics of scholarly rank. Many know "Kilmeny" and "Bonnie Prince Charlie." But all know Burns as household words.

The brevity of Burns' career awakens pity and love for him; but the inwardness of his poetry makes its own place, as the spell of beauty everywhere is received.

The final test of the value of Burns as an artist is the British acceptance of him among their honored poets in the Poets' Corner of Westminster, near to the great bard of Avon.

140 pages. $2.00. Mic 58-4025

BIOLOGY — GENETICS

A STUDY OF LIVER COENZYME A LEVELS AND TOTAL FATTY ACIDS IN TURTLES UNDER VARYING ENVIRONMENTAL CONDITIONS

(Publication No. 25,113)

Stanley John Brumleve, Ph.D.
St. Louis University, 1957

Experiments were designed to provide additional information concerning liver fatty acids and coenzyme A concentration in turtles. Four groups of animals were used. One group was maintained under laboratory conditions for eight weeks, a second group was fasted at room temperature for eight weeks, a third group was maintained between 0°C. and + 5°C. for eight weeks, while the fourth group, "wild" animals, was sacrificed within a few days after capture. Total liver fatty acids were determined and coenzyme A was assayed. The "wild" animals had the highest coenzyme A concentration, 49.6 $\pm$ 2.0 units, and the highest total fatty acids, 5.47 $\pm$ 0.86 per cent. Starved animals had the least coenzyme A concentration 29.2 $\pm$ 2.6 units and total fatty acids were 2.81 $\pm$ 0.44 per cent. Coenzyme A in laboratory animals was 39.0 $\pm$ 1.5 units and total fatty acids 3.80 $\pm$ 0.64 per cent while coenzyme A and total fatty acids values were 35.5 $\pm$ 1.6 units and 4.09 $\pm$ 0.21 per cent for cold exposed animals.

It appears that coenzyme A degradation does not proceed as rapidly in torpid animals as it does in fasted animals. Liver total fatty acids/coenzyme A ratios calculated from the mean values for each group of animals were not markedly different. In general a parallelism exists between liver total fatty acids and coenzyme A in the four groups of animals studied, yet this is probably not a cause and effect relationship.

46 pages. $2.00. Mic 58-4026

OBSERVATIONS ON MUTATIONAL AND TERATOGENIC CHANGES IN THE MOUSE*

(Publication No. 23,188)

Elizabeth Mercy Moothart Center, Ph.D.
Stanford University, 1957

Genetic and developmental effects of nitrogen mustard, methylbis(beta-chloroethyl)amine hydrochloride, or HN_2, have been investigated in the house mouse. Varying concentrations of this reagent were administered as subcutaneous or intra-peritoneal injections, by direct application to the gonads, or through the intra-uterine treatment of mice of different ages from inbred and hybrid lines. The treated mice and their descendants, maintained through the $F_1 \times F_2$, or later generations, were examined for visible effects, either external or internal. Insofar as space would permit, comparable control stocks were maintained and examined in the same manner.

Thirty-seven different anomalies were noted. Detailed data were obtained from genetic, and in some cases embryological, studies of certain of these variants, including pink-eyed dilution, dorsal excrescences, syndactyly, preaxial polydactyly, postaxial polydactyly, the "luxoid" complex, kinky tail, duplicate lower incisors, situs inversus, and absence of the gall bladder. Study of these conditions, at least some of which were presumably induced by the treatment, reveals that the inheritance of many of them is determined not only by easily inferred hereditary units (genes) but also frequently by overall patterns of development which, in turn, are controlled by both genetic and non-genetic factors. It is these, more or less concealed moulding agencies, which would seem in many cases to furnish a partial explanation for the familiar phenomena of diminished penetrance and varied expressivity.

The effects produced in embryos whose mothers were injected during pregnancy were relatively consistent and predictable. Various types of defects were observed, including hydrocephaly, cerebral hernia, eye and ear defects, cleft palate, defective lower jaws, abnormal tails, defective feet, and permanent hairlessness over certain areas of the body. The nature of these defects depends to a major extent on the precise moment in embryonic development at which the mice are subjected to treatment. Many of the directly induced anomalies are phenocopies of characteristics which have a known genetic basis. These results show that phenotypic expression of individual traits represents the product of a functional blend of genetic and non-genetic factors.

This work and that of several other investigators shows that nitrogen mustard has a preferential action on actively metabolizing tissues and dividing cells, the immediate effect, according to Bodenstein and others, being an interference with the synthesis of desoxyribonucleic acid. On this basis, mutagenesis and teratogenesis, which at first sight appear to be unrelated phenomena, find a common causative factor. 108 pages. $2.00. Mic 58-4027

*This investigation was supported by a research grant (No. 1385, administered by Professor C. H. Danforth) from the Department of Health, Education and Welfare, Public Health Service, National Institutes of Health.

THE GROWTH AND MORPHOLOGY OF TETRAHYMENA AS INFLUENCED BY AMINOAZOBENZENE DYES AND CERTAIN METABOLIC INHIBITORS

(Publication No. 24,788)

Miriam I. Jacob, Ph.D.
New York University, 1955

Adviser: M. J. Kopac

The growth of the protozoan Tetrahymena pyriformis (strain E) in pure culture may be compared to the growth of somatic tissue cells in multicellular organisms. The activities of various agents which have been used for the study of carcinogenesis in mammalian organisms have been evaluated on the basis of their action on the growth and morphology of Tetrahymena.

The non-ionic detergent, polyoxyethylene sorbitol cottonseed oil ester, was used as the solubilizer for the organic compounds studied. Addition of the solubilizer to the basal proteose peptone medium in which the Tetrahymena were cultured stimulated the growth and raised the maximum yield. The concentration of the chemicals in the medium influenced the growth rate of the Tetrahymena cultures. The following aminoazobenzene dyes, aminoazobenzene, monomethylaminoazobenzene, dimethylaminoazobenzene, 3'-methyl-4-dimethylaminoazobenzene, and Methyl Red, at a concentration of 100 micrograms per ml. of culture medium, inhibited the growth of the Tetrahymena. The rate and amount of growth was generally dependent upon the immediate environment of the Tetrahymena and was unrelated to previous treatment although adaptation to growth inhibiting substances was observed in at least one instance.

Modification of the morphology of the Tetrahymena, such as irregular ovoid and pyriform shapes with posterior projections, was induced by the above growth-inhibiting agents and also by 3'-methyl-4-aminoazobenzene, 2-methyl-4-dimethylaminoazobenzene, 2'-methyl-4-dimethylaminoazobenzene, and 8-azaguanine. The Tetrahymena grown in all of the aminoazobenzene dyes investigated, with the exception of Methyl Red, contained yellow globules in comparison to similar, colorless organelles in the control Tetrahymena. The increasing age of the culture and the number of generations of growth in specific aminoazobenzene dyes enhanced the morphological effects of these compounds. Abnormalities in the size and shape of the Tetrahymena usually occurred in older cultures after several transfers through media containing the active agents. It has been suggested that this is an adaptation phenomenon.

8-Azaguanine, at a concentration of 300 micrograms per ml. of medium, depressed the rate of growth, reduced the size, and induced changes in the shape of Tetrahymena. Media containing a mixture of 8-azaguanine (300 micrograms per ml.) plus either aminoazobenzene, monomethylaminoazobenzene, dimethylaminoazobenzene, 2-methyl-4-dimethylaminoazobenzene, 2'-trifluoromethyl-4-dimethylaminoazobenzene, or 3'-methyl-4-dimethylaminoazobenzene (all at 100 micrograms per ml.) induced a greater depression in the growth rates of the Tetrahymena than any of the agents alone. The most active mixture, which contained aminoazobenzene and 8-azaguanine, prevented growth of the Tetrahymena after the first transfer.

Growth of the Tetrahymena was completely inhibited in a medium containing 3,5-dinitro-o-cresol at a concentration of 22 micrograms per ml. Partial reduction of growth occurred in 2.2 micrograms per ml. of this compound and in 2,4-dinitrophenol at 18 micrograms per ml. Both agents decreased the size of the Tetrahymena.

In order to ascertain how any compound acts on a cell it is important to determine where the agent is localized in the cell. One approach to this problem is differential centrifugation. Fixation and staining indicated the following distribution of intracellular components in the centrifuged Tetrahymena. The nucleus was displaced to the centrifugal half of the cell. The contractile vacuole was usually displaced to the centrifugal portion but could occasionally be observed in the centripetal end of the stratified Tetrahymena. The centripetal half contained lipoidal material which was present in much larger quantities in the Tetrahymena grown in media containing the sorbitol cottonseed oil ester than in the ciliates cultured in basal proteose peptone medium. The centripetal portion of stratified whole ciliates grown in media containing an aminoazobenzene dye was bright yellow. The results suggest that the aminoazobenzene dyes become associated with the lipoidal components of the Tetrahymena.

87 pages. $2.00. Mic 58-4028

THE EFFECT OF AGE AND ENVIRONMENT ON HOMOTRANSPLANTATION OF SKIN IN THE RAT

(Publication No. 24,887)

Myron Samuel Jacobs, Ph.D.
New York University, 1955

Adviser: Earl O. Butcher

The techniques of subpannicular implantation and full thickness exchange grafting were employed to study the effects of donor age on skin homotransplantation in the rat. In addition, an operative technique was developed to open large cysts resulting from implantation and bring them to the surface so as to reestablish normal surface relations between donor and recipient skin.

Donor tissue was obtained from potentially pigmented fetuses and from visibly pigmented postpartal pups. Donor age ranged from 12 day fetal to 22 day postpartal. All recipient animals were young albino rats ranging in age from 17 to 54 days. The fact that integumental melanin in the rat is restricted to hair follicles makes it a peculiarly satisfactory animal for skin homotransplantation studies. The presence of pigmented hairs in a graft recipient affords indisputable evidence that donor tissue has survived.

Implantation of fetal and postpartal skin resulted in the formation of small or large palpable cysts within a week. It soon became evident that large implants were better able to produce large cysts than small implants. Of 139 small implants placed into a group of 60 animals, 73% produced small cysts which soon regressed and only 27% formed large cysts that could be exteriorized; only one such exteriorized cyst survived permanently on the surface.

Each of a second group of 37 rats received a pair of large and small implants. Of these, 70% of the cysts resulting from small implants regressed whereas only 35% of the cysts resulting from large implants did. Seventeen cysts resulting from large implants were exteriorized.

Another group of 14 rats received 29 large implants. Almost 80% of these implants formed large cysts. Two of eighteen exteriorized cysts survived indefinitely.

A fourth group of 23 animals was employed to determine whether there was any difference in fate between implanted pieces of skin and surface exchange homografts. The results indicated that both types of homotransplants acted in a parallel fashion.

Seven littermates in a fifth experimental group each received paired large and small implants. When large cysts became palpable, they were brought to the surface. Four rats containing six exteriorized cysts survived permanently.

The 33 rats in sixth and seventh experimental groups received either large or small full thickness exchange skin homografts. Some were semistarved and others were well fed. Semistarvation, as well as large size, appeared to benefit graft survival.

From the preceding experiments, the following conclusions were drawn:

1. When small implants were used, postpartal and fetal skin had the same chance for survival.
2. When large implants were employed, younger fetal skin (12 and 13 day fetal) survived better than did older fetal skin (17 to 21 day fetal).
3. Large implanted pieces of skin had a much better chance of forming large cysts than did small pieces.
4. The fate of full thickness exchange skin homografts paralleled that of implanted skin.
5. Large full thickness exchange grafts survived better than did small ones.
6. Lowering skin metabolism by semistarvation bettered the survival of skin homotransplants.

From the experimental results and graft histology, a hypothesis was offered that the better survival of large cysts and large full thickness exchange skin homografts was due to a combination of inadequate early vascularization and a state similar to immunological paralysis.

79 pages. $2.00. Mic 58-4029

INHERITANCE OF RESISTANCE TO PHYSIOLOGIC RACES T-8, T-16, AND T-17 OF TILLETIA CARIES (DC.) TUL. IN HYBRIDS OF (27-15 x RIO-REX) - SELECTION 53 AND ELGIN WHEAT

(Publication No. 24,638)

Akram Hamid Jaff, Ph.D.
Oregon State College, 1957

Major Professor: R. J. Metzger

The most satisfactory means of controlling bunt in wheat is by growing resistant varieties. Both species of the common bunt fungus, Tilletia caries and Tilletia foetida, are highly specialized into distinct physiologic races. Because of this physiologic specialization, it is difficult to produce wheat varieties that are consistent in their resistance. Various workers have identified major, minor and modifier genes for resistance to one or more physiologic races, but no gene has been identified that controls all the races of bunt fungi.

In a genetic study of inheritance of resistance, Selection 53 of (27-15 x Rio-Rex) was crossed with Elgin wheat in 1953 at the Pendleton Branch Experiment Station, Pendleton, Oregon. F_1 and F_2 generations were protected from bunt during 1954 and 1955 growing seasons. In the fall of 1955, seeds from F_2 plants were divided into three portions and each portion was inoculated with a particular race of the fungus. The spores were applied in a suspension of five per cent of Methocel (methylcellulose) to the seeds. The races used are identified as T-8, T-16, and T-17 of Tilletia caries. Data from the F_2 population and 453 F_3 progeny rows were analyzed:

1. The inheritance of resistance to T-8 is thought to be conditioned by two major genes, one acting as dominant and the other as recessive and both linked with 16 per cent crossing-over. It is highly probable that the dominant gene is either the Turkey or Rio gene identified by other workers, and also that the recessive gene is the same as the Ridit gene.
2. The inheritance of resistance to T-16 and T-17 is conditioned by two major genes and one or two modifiers with different levels of susceptibility in each race. One of

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the major genes here is thought to be the Martin 1 gene for resistance, while the other is the Ridit gene.

3. Except for the recessive gene, the genes that condition resistance to T-16 and T-17 are different from the gene that conditions resistance to T-8.

4. No relationship was found between inheritance of resistance to these three physiologic races and inheritance of morphologic characters spike density and awnedness.

5. Selection 53 wheat has at least three major genes for resistance to bunt, plus one or more modifiers.

94 pages. $2.00. Mic 58-4030

AN ANALYSIS OF THE PIGMENTARY PROCESS IN THE EYE OF THE MOUSE

(Publication No. 23,452)

Louis J. Pierro, Ph.D.
Brown University, 1957

Two types of melanocytes, epithelial and dendritic, comprise the full pigmentary complement of the eye of the mouse. As the result of known gene mutations, however, several variations may occur in the pigmentary complement which involve the occurrence of one or the other type in either a certain region, or in the whole eye. The present analysis of the pigmentary process was undertaken to lay a foundation for the investigation of the mechanism by which genes exert these effects.

On the basis of a morphological study it has been determined that a complete set of both melanocytes is present by 12 days after birth. When the pigment content of the eye is measured, however, it is found that synthesis continues to 20 days. After a period of rest from 20 to 30 days of age in the eyes of C^{57} Black mice and 20 to 40 days of age in the eyes of C^{57} Brown mice, pigment is again produced until about 50 days. Tyrosinase activity, however, can be demonstrated from birth to after 50 days of age. Since no further increase in cells is noted, it is presumed that this extra synthesis occurs within cells already present. A study of $\underline{Mi^{wh}}\underline{Mi^{+}}$ mice, which lack dendritic melanocytes in the choroid, and Wwss mice, which lack all dendritic melanocytes, demonstrates that only dendritic melanocytes are involved in the second period of pigment synthesis.

The first phase of the pigmentary process in the eye is sensitive to x-irradiation in mice younger than 12 days of age. X-irradiation results in a decrease in the rate of pigment synthesis between 12 and 20 days of age. Pigment synthesis in both epithelial and dendritic melanocytes is affected. It is suggested that failure of melanocyte division is the primary effect of x-irradiation.

In contrast, the second phase of pigmentation is apparently not sensitive to x-rays. This portion of the pigmentary process occurs precociously in animals treated with anterior pituitary, or small doses of testosterone. It can be suppressed partially in C^{57} Black mice and completely in C^{57} Brown mice if the animals are castrated. This effect may be reversed by treatment with anterior pituitary. These results indicate a role of the pituitary gonadotropins in the second phase of the pigmentary process.

A bi-phasic pigmentary process is also present in the eye of homozygous and heterozygous Light mice. The period of inactivity in $\underline{B^{lt}}\underline{B}$ mice, however, extends only from 16 to 20 days. No explanation is apparent for this difference. Comparison of the pigmentary process in homozygous and heterozygous Lights indicates that B^{lt} affects both the number of dendritic melanocytes and the extent of melanogenic activity per cell. B^{lt} is completely dominant to b but incompletely dominant to B. While the activity per cell is determined by B^{lt}, the number of cells present in $\underline{B^{lt}}\underline{B}$ eyes is determined by B.

70 pages. $2.00. Mic 58-4031

THE EFFECTS OF FREEZING AND STORAGE ON THE OXIDATIVE PHOSPHORYLATION OF MITOCHONDRIA

(Publication No. 25,133)

Carmelo Anthony Privitera, Ph.D.
St. Louis University, 1957

Twenty-five per cent and 50% suspensions of mitochondria, in a sucrose-Versene mixture, were prepared from the livers of three month old, male, albino rats. The oxidative phosphorylation of these preparations was measured. Oxygen uptake was determined by means of a Warburg constant volume respirometer. Inorganic phosphate utilization was determined by difference. Aliquots (0.8 ml) of mitochondrial suspensions in Kimball glass tubes were frozen slowly by immersing the tubes, with swirling, in low temperature sludges or in liquid air. Rapid freezing was accomplished by forcibly ejecting the suspension from pipettes into pre-cooled tubes. The frozen aliquots in several tubes were thawed rapidly, pooled, and the oxidation of alpha-ketoglutarate and the change in inorganic phosphate in the system was measured.

Mitochondrial suspensions were frozen rapidly and slowly at -20°, -40°, -63°, -94°, and -192°. At all temperatures, except -20°, activity was demonstrable after thawing. The P/O ratios of suspensions frozen slowly at -63° and either frozen slowly or frozen rapidly at -94° and -192° were not significantly different from those of the control materials which were not frozen. All activity was lost in frozen suspensions stored at -40° for 24 hours. Suspensions stored at -76° and -192° showed activity at the end of 24 hours. Maximum retention of activity was found in suspensions frozen slowly at -192° and stored at -192°. The means of the μ moles of phosphorus taken up (P), the μ atoms of oxygen utilized (0), and the phosphorus/oxygen ratios (P/O) were as follows: control, 17.3 (P), 6.8 (0), 2.5 (P/O); frozen slowly at -192° and thawed immediately, 13.8 (P), 6.1 (0), 2.2 (P/O); frozen slowly at -192° and stored at -192°, 12.3 (P), 6.5 (0), 2.2 (P/O). Suspensions stored at -76° for 24 hours retained 54% of their activity. Further decreases did not occur at the end of 120 hours of storage at either -76° or -192°.

Fifty per cent mitochondrial suspensions frozen slowly at -76° or -192° and stored at -76° for 120 hours retained over 76% of the phosphorylative capacity and over 88% of the oxidative capacity. Those 50% suspensions frozen slowly at -192° and stored at that temperature for 120 hours retained 96% of the ability to esterify inorganic phosphate and 100% of the ability to utilize oxygen.

Cyclic freeze-thawing of 25% and 50% mitochondrial suspensions demonstrated that 50% mitochondrial suspensions were more stable than 25% suspensions. The 25% suspensions lost 10% of their activity after each of four freeze-thaw cycles. The 50% suspensions leveled off at 85% of the control activity following similar treatment.

These data suggest that under carefully controlled conditions of freezing and thawing the oxidative phosphorylative capacities of mitochondria may be substantially retained. 44 pages. $2.00. Mic 58-4032

GENETIC INTERPRETATION OF HETEROSIS AND MATERNAL EFFECTS IN REPRODUCTION AND GROWTH OF SWINE

(Publication No. 25,273)

Pierre Rene Rio, Ph.D.
University of Illinois, 1957

A total of 376 gilts were involved in this study of reproductive performance and growth rate in hybrid swine over a period of two years. The following breeding groups were represented: purebred Hampshire (HH) and Yorkshire (YY), both reciprocal first generation crosses (YH with Hampshire mother, HY with Yorkshire mother), the backcrosses of the YH to Hampshire or Yorkshire males (H(YH) and Y(YH) respectively), and the backcrosses of the HY to Hampshire or Yorkshire males (H(HY) and Y(HY) respectively). The foundation purebred females and the males were all of outbred origin. In each year different males were used and the gilts were assigned at random to be mated with them.

All gilts were studied for growth rate (weight at 154 days of age). In each year a random sample of gilts was killed at a certain time of pregnancy to determine the number of eggs ovulated and that of eggs fertilized (first year) or of living embryos (second year). In each year another random sample was permitted to farrow.

The overall average loss of eggs or embryos from ovulation to farrowing was 5.29 eggs (37% or the number of eggs ovulated). The losses could be assessed to the following accidents of pregnancy: lack of fertilization (24%), lack of implantation (23%), embryonical death during the first half of pregnancy (14%), embryonical death during the second half of pregnancy (18%), and stillbirths (21%). The data did not show differences between breeding groups with the exception of the HY which lost only 20% of the number of eggs ovulated. This difference appears due to a higher fertilization rate and a lower number of stillbirths. The heritability of litter size was 5.7% and that of ovulation rate 1.2%.

Ovulation rate was very strongly influenced by the breeding of the gilt. The purebred were not significantly different (0.42 eggs). The HY showed a significant negative heterosis (-1.96 eggs) while the YH did not show any. The difference of 2.07 eggs between reciprocal crosses was significant. It could not be determined from the data whether the difference between the heterosis of the Y(YH) (2.55 eggs) and that of the H(YH) (L.09 eggs) had a biological significance. This could not be determined either for the Y(HY) (heterosis, 0.27 eggs) and the H(HY) (heterosis, -1.05 eggs). Both possibilities were considered in the discussion. The maternal effect of the first generation crossbred could be interpreted as a gene-cytoplasm interaction. The cytoplasm of the ovulating gilt appeared as a mixture of Hampshire and Yorkshire cytoplasm in quantities respectively proportional to the amount of chromosomes of each breed in its maternal genome (maternal inheritance). The cytoplasm of one breed in the ovulating gilt would interact with the part of its genome which is of opposite breed with a dosage effect. This appeared to be verified in the case of survival after birth where one further generation was available. This type of effect may be due to different secretion rates of proteins by different RNA in different cytoplasms.

There was a negative significant correlation (-0.34) between the age of gilts at first heat and their weight at 154 days of age. The purebreeds differed significantly in weight at 154 days of age, and heterosis was 4.2% of the total body weight. This heterosis arose mainly from two of seven sires used, a Yorkshire (heterosis 10.5%) and a Hampshire (heterosis 16.8%). The crossbred progeny of both was heavier than either purebreeds. Heterosis in this case could not be explained by overdominance. The rate of deposition of fat per pound of gain of weight at 154 days of age did not differ significantly between breeds. 99 pages. $2.00. Mic 58-4033

ON MORPHOMETRIC AND SEROLOGICAL RELATIONSHIPS WITHIN THE LIMULIDAE, WITH PARTICULAR REFERENCE TO LIMULUS POLYPHEMUS (L.)

(Publication No. 24,890)

Carl Nathaniel Shuster, Jr., Ph.D.
New York University, 1955

Adviser: Harry A. Charipper

This is a study of horseshoe "crabs" (Limulidae). Throughout, the compelling desire was to find out more about the animals. Two distinct phases of research were pursued: (1) a description of the Limulidae based upon morphometric and serological data, and (2) observations on the natural history of Limulus.

The investigation was carried out under the cosponsorship of Professor Harry A. Charipper, New York University, and Professor Thurlow C. Nelson, Rutgers University, The State University of New Jersey.

The thesis was largely supported by a grant from the Research Council, Rutgers University, The State University of New Jersey (July, 1953, to June, 1955). A preliminary study was sponsored by the Woods Hole Oceanographic Institution during the summers of 1949 and 1950.

Over 20,000 specimens of Limulus polyphemus, both adults and immature specimens, were collected from fifteen localities along the eastern coastline of the United States, from Maine to Florida, and varying amounts of morphometric data obtained. The number of specimens studied was sufficiently large to permit statistical treatment of the data. Adults of the Indo-Pacific species in the United States National Museum collection, Tachypleus tridentatus, 5 specimens, and Carcinoscorpius rotundicauda, 2 specimens, were studied.

The text of the thesis, 119 pages, includes 23 tables of

data and a bibliography of 131 references. In addition, there are 36 plates with 101 figures and an appendix of 30 pages.

Morphometric considerations included a study of the external anatomy of Limulus with twenty-two figures, a terminology to describe the topographical characteristics, and a list of the synonyms in terminology. Thirty-four photographs of Limulus show sixteen representative adult males and females and eighteen examples of variations and abnormalities. Aspect views of the Indo-Pacific Limulidae are shown by thirty-three pictures.

The morphometric data revealed that the American species of horseshoe "crab," Limulus polyphemus (L.), is comprised of morphometrically distinguishable races which are for the most part geographically isolated. Although the geographical range of this species is from Yucatan, Mexico, to Maine, the optimum portion of this range, judged by the body size of the adults, is from Georgia to Cape Cod. The animals are smaller in the southern and northern portions of the range.

Body proportions, relative to the size of the animal, the sex, and the geographical location have been studied and significant results have been obtained.

The morphometric data show as great or greater agreement between Limulus polyphemus (subfamily Limulinae) and Tachypleus tridentatus (subfamily Tachypleinae) than between Tachypleus and Carcinoscorpius rotundicauda (subfamily Tachypleinae).

Precipitin reaction tests were conducted on the serum of the three species of Limulidae listed above. Serologically the Indo-Pacific species are far removed from Limulus indicating that the three species, on the basis of their serum proteins, are not cogeneric.

Observations on the natural history of Limulus were on the season of spawning and spawning behavior, growth stages and increments of growth. The one-year age class in one population was determined. Data suggesting that adult males do not molt were given. A field test for distinguishing between immature and adult females was explained. The unusual distribution of Limulus within the Gulf of Mexico, where it abounds at the "entrance" to the Gulf, along the shores of Florida, and Yucatan and Campeche, was discussed. The enemies of Limulus were listed and certain abnormalities of the exoskeleton, particularly the telson, described.

This thesis increases our knowledge of the horseshoe "crab": the taxonomy of the extant species and the natural history of Limulus polyphemus. It contains information that should be of interest to paleontologists, physiologists, and to zoologists in general.

287 pages. $3.70. Mic 58-4034

BOTANY

THE OAK WILT FUNGUS, CERATOCYSTIS FAGACEARUM (BRETZ) HUNT: STUDIES OF THE RATE AND EXTENT OF FUNGUS PENETRATION IN OAK ROOTS AND THE NATURE OF A TOXIC PRINCIPLE IN OAK HEARTWOOD WHICH INHIBITS GROWTH OF THE FUNGUS

(Publication No. 25,195)

James Donald Bilbruck, Ph.D.
University of Illinois, 1957

A study of penetration by the oak wilt fungus into the roots of black oaks was carried on in Sinnissippi Forest, Oregon, Illinois from July 23, 1956 until July 10, 1957. Seventy-five trees were artificially inoculated with oak wilt fungus conidia in the trunks, in the summer of 1956. Seventy trees were root-inoculated with the fungus, in the summer of 1956. Fifty trees were trunk-inoculated and 50 were root-inoculated with the fungus in the spring of 1957. A similar study of red oaks was carried on in the Natural History Survey Nursery, Champaign, Illinois. Fifty trees were root-inoculated with the fungus in the summer of 1956, and an additional 50 trees were root-inoculated in the spring of 1957.

Penetration of the roots of red and black oaks by the oak wilt fungus was much slower than penetration of the stems from both trunk and root inoculation. Spread of the fungus in roots began about one month after artificial inoculation, and progressed slowly. Penetration of the root systems of black oak forest trees was found to be incomplete a year after inoculation.

Black oaks showed no differences in susceptibility to oak wilt because of size differences. Root inoculation was about 50% effective, and trunk inoculation was nearly 100% effective in causing disease. Progress of the disease apparently was not related directly to size.

Red oak trees less than 2" D.B.H. showed about the same pattern of disease spread in tops and roots as the black oaks. Artificial inoculation of red oaks in the roots was 100% successful in causing disease. This appears to indicate greater susceptibility to oak wilt in red oaks than in black oaks.

The oak wilt fungus would not grow on the heartwood of red, black, northern pin, or bur oaks.

A toxic principle to the oak wilt fungus contained in the heartwood of these oaks was found to be soluble in water, thermostable, non-volatile, and diffusible in agar-containing culture medium.

Tannic acid, although a commercial preparation was toxic to the oak wilt fungus at concentrations of 1% or more, was apparently not the only substance contained in the extracts which may be toxic to the fungus. The heartwood did not support fungus growth, but the bark supported fungus growth; both contain an abundance of tannin.

The toxic principle appears to be neither a pigment, such as quercetin, nor an alkaloid.

The toxic principle appears to be neither an inorganic nor a volatile organic acid.

It was indicated by these tests that an active toxic principle in the heartwood of these species of oaks is tartaric acid. This acid is non-volatile, thermostable, highly soluble in water, and, in the pure state, toxic to the oak wilt

fungus at a concentration of 0.6% and above, in water solution, mixed with wheat bran agar.

72 pages. $2.00. Mic 58-4035

NATURAL AND INDUCED VARIABILITY IN PHYTOPHTHORA CACTORUM (L.&C.) SHROET. AND PHYTOPHTHORA CINNAMOMI RANDS

(Publication No. 24,627)

Ivan William Buddenhagen, Ph.D.
Oregon State College, 1957

Major Professor: Roy A. Young

Mutants were induced in hyphae of Phytophthora cinnamomi by X-ray irradiation and in uninucleate zoospores of P. cactorum by X-ray and ultraviolet irradiation. Among the mutants, differences in colonial morphology, microscopic characters, and pathogenicity were found which were greater than such differences among natural isolates.

Some of the mutants of P. cinnamomi obtained with 4000 roentgens produced small, scarcely zonate colonies. Hyphal swellings typical of P. cinnamomi were absent in two mutants. Eight mutants were pathogenic to apple fruits and retained their mutant phenotypes after recovery from the fruits. Two of three mutants tested were not pathogenic to Chamaecyparis when tested by soil infestation, nor did they survive in the soil.

Isolates of P. cactorum differed in morphology, but zoospore colonies derived from any isolate were identical. No lasting variability was found in colonies derived by zoospores from a single zoospore colony. However, developing colonies showed differences due to growth-lag. Oospore germination was not obtained from combination treatments of glutathione, temperatures, and freezing.

Mutations were easily induced with the ultraviolet light used, mainly the wavelength 2537 A. Techniques were developed for inducing, selecting, and grading mutants which overcame difficulties due to the presence of sporangia and multiple zoospores. Lethality and mutant dosage response curves were obtained. A 50 percent mutation rate was the highest obtained. X-ray dosages greater than 2250 r were necessary for obtaining many mutants. X-rays were not as satisfactory as ultraviolet for mutation induction. Mutants were obtained which differed from the wild type in macro- and microscopic morphologic characters, and in growth rate. Many of the characters which differed from those of the wild type are those used in taxonomy. Among the mutants, sporangia differed in size and shape. Hyphal characters commonly varied, with the production of various degrees of knobbing, clubbing or spherical swellings. Some mutants differed sufficiently to make their identification as P. cactorum impossible. The mutants varied greatly in their ability to grow on one natural and four synthetic media. Although most of the mutants grew less than the wild type, one produced three times as much growth as did the wild type in minimal medium. No mutant having a specific biochemical block was found among the 300 tested.

The stability of several mutants was tested by comparing single zoospore colonies derived from them. Anomalous behavior was found, since such colonies from one mutant were not identical. Descendants of one mutant always produced a small proportion of dwarf colonies and a large proportion of large colonies characteristic for each descendant. Zoospore colonies derived from either the dwarf or large type produced both types. Most colonies derived from another mutant were identical to the parent mutant but six other morphologic types were produced, one of which was not separable from the wild type. Zoospores of the wild type and of one unstable mutant were found to contain only one nucleus per zoospore.

Pathogenicity of 11 isolates and 50 mutants to young peach trees was tested. Pathogenicity of the mutants ranged from none, to pathogenicity equal to that of the wild type. Canker size was in general correlated with colony size on white bean glucose agar. However, there were some notable exceptions, since some large colonies produced very small cankers. Pathogenicity of zoospore subcultures of five mutants was investigated. Significant differences occurred within three of five subculture series. Pathogenicity in all but one series was reduced much below that of the wild type.

The variability exhibited by the mutants illustrates the great potential for variation and the futility of drawing narrow species lines in the genus Phytophthora.

121 pages. $2.00. Mic 58-4036

THE ELONGATION OF THE INTERNODE CELL WALL OF NITELLA

(Publication No. 23,824)

Paul Barnett Green, Ph.D.
Princeton University, 1957

The internodes of the alga Nitella are single cylindrical cells; the growth of these cells, in the size range 2mm. to 45 mm., was studied in N. axillaris. Growth of the cylindrical surface was found to be evenly distributed over the surface. As the cell elongated, the top of the cell was found to rotate with respect to the base, the twisting being evenly distributed along the cell axis. Thus the cell, and the cell wall, show "spiral" (helical) growth.

The structure of the wall was investigated with the polarized light and electron microscope. The electron microscope revealed the presence of microfibrils, believed to be composed of cellulose, about 70 Angstroms in diameter. Investigations with the polarized light microscope showed that these fibrils were always in a net transverse arrangement during elongation, despite varying amounts of twist. Thus the helical component of growth does not appear to be related to a net helical arrangement of microfibrils.

The growth of the cell wall was studied further, without special reference to spiral growth. A net transverse arrangement of microfibrils, as found in the Nitella cell wall, could include many microfibrils oriented in directions other than the transverse. Information from two sources indicated, however, that the transverse orientation prevailed in all regions of the wall. Electron micrographs of ultra-thin transverse sections suggested a similar microfibrillar arrangement throughout the cross-section of the wall. Also, walls of non-elongating cells

appeared to gain new microfibrils in the same orientation as those previously present. This second source of evidence came from the study of cells whose growth had been inhibited by a high osmotic concentration of the surrounding medium.

Experiments involving the incorporation of the isotope tritium into the cell wall indicated that the addition of new wall material took place at, or very near, the inner surface of the wall. If new wall substance is deposited at or near the inner surface of the elongating wall, outer portions of the wall must be spread over an even larger surface. Since tears or cracks are not found in the wall, the spreading of regions of the wall outside the growing portion apparently involves a gradual adjustment of wall members. This adjustment probably entails the motion of microfibrils relative to one another; the adjustment appears to take place without any great change in the transverse alignment of the wall microfibrils.

In brief, the expansion of the cylindrical cell wall of Nitella is characterized by the deposition of microfibrils at or near the inner surface of the wall. These fibrils are oriented transversely to the cell axis. Fibrils of the outer portions of the wall accommodate the expansion of the inner portion by undergoing motion relative to each other but these microfibrils retain the transverse orientation.

110 pages. $2.00. Mic 58-4037

SOME ASPECTS OF THE AUTECOLOGY OF APHANIZOMENON FLOS-AQUAE BORN. ET FLAH. STUDIED UNDER CULTURAL CONDITIONS

(Publication No. 24,643)

Jack Lamont McLachlan, Ph.D.
Oregon State College, 1957

Major Professor: Harry K. Phinney

This study reports investigation of some aspects of the major nutrient requirements of Aphanizomenon flos-aquae Born. et Flah. It was hoped that the results would be applicable in answering some of the ecological problems relative to this species.

This alga had not been previously successfully grown in culture for experimental purposes. Other investigators had suggested that some unknown organic metabolite was necessary in the nutrition of A. flos-aquae. During the course of this investigation, the alga was successfully grown on two different types of inorganic media. Initially, the alga was successfully grown on a physiologically unbalanced medium. Later experiments showed that if the concentration of calcium, nitrogen, and iron were comparable to the concentration found suitable in the physiologically unbalanced medium, a physiologically balanced medium could be successfully employed.

Of the major nutrients investigated, nitrogen, phosphorus, and possibly iron were required in amounts that indicated they probably exert a limitation on the growth of the alga in nature. Nitrogen was the element necessary in the largest concentration for good growth, and the requirement for it considerably exceeded that for phosphorus. It was found the concentration of iron supplied as ferric citrate-citric acid could be considerably reduced when iron was supplied in a chelated form. Toxic effects were produced by iron chelate at lower concentrations than produced toxicity when iron was introduced in the citrate complex. There was a definite, but small, requirement for calcium, although in large concentrations it was found to inhibit the growth of the alga. No quantitative or qualitative study was made of the micro-nutrient requirements. The media used were supplied with Arnon's modification of Hoagland's mixture of micro-elements.

The alga required an alkaline medium. High light intensities were detrimental to the growth of the alga, and temperature, within the ranges used, had very little, if any, effect upon growth.

The morphology of the alga was very different from that of the "wild" form. This may have been a reflection of the cultural conditions, or it may have been the result of a mutation caused by ultra-violet irradiation used in attempts to rid the cultures of bacteria.

131 pages. $2.00. Mic 58-4038

EFFECTS OF CERTAIN TRACE METALS ON THE FUNGITOXICITY OF SODIUM DIMETHYLDITHIOCARBAMATE

(Publication No. 25,338)

Bernard Clair Smale, Ph.D.
University of Maryland, 1957

Supervisor: Dr. Carroll E. Cox

The effect of certain heavy metals on the fungitoxicity of sodium dimethyldithiocarbamate (Na-DMDT) was studied in the laboratory. Saccharomyces pastorianus was the test organism. A bimodal dosage-response has been observed when a number of fungi have been exposed to a range of concentrations of this fungicide, i. e. growth is inhibited by low concentrations (first zone of inhibition), growth occurs at somewhat higher concentrations (zone of inversion growth) and growth is again inhibited when concentrations are further increased (second zone of inhibition). Yeast cells that were sufficient in all trace metals or deficient in 1 or more trace metals were prepared by growing them through 3 transfers of 24 hr. each in a liquid medium sufficient in all trace metals or deficient in 1 or more of the metals. When exposed in liquid medium to concentrations of Na-DMDT ranging from 0.018 - 10 p.p.m., cells sufficient in trace metals were markedly inhibited and showed only a slight zone of inversion growth, while trace metal deficient cells were less severely affected producing from 20 to 90 percent of the growth of comparable cells not exposed to the fungicide. The trace metal deficient cells exhibited a striking zone of inversion growth. When trace metals were omitted from the medium in which trace metal deficient cells were exposed to the fungicide, their response was not materially affected; but when trace metals were omitted from the medium in which trace sufficient cells and zinc sufficient cells were exposed to the fungicide, a zone of inversion growth occurred at intermediate concentrations of the toxicant.

It was concluded that the history of the cells with respect to trace metals prior to treatment with the fungicide determines their response to low and intermediate

concentrations of Na-DMDT. At higher concentrations (second zone of inhibition), the response of the cells to the fungicide appears to be independent of their prior treatment with trace metals.

Cells sufficient in copper only or iron only or sufficient in all trace metals except zinc responded to the fungicide like trace deficient cells. Cells sufficient in zinc only, however, responded essentially the same as trace sufficient cells except that the zone of inversion growth began at a lower concentration of Na-DMDT than in the case of trace sufficient cells. When the zinc sufficient cells were exposed to the fungicide in medium containing trace metals, onset of the zone of inversion growth was at a higher concentration of Na-DMDT which was identical with initiation of the zone of inversion growth in the case of trace sufficient cells. It was concluded that zinc is the critical metal involved in the toxicity of low concentrations of Na-DMDT to S. pastorianus and that the zinc must be in or closely associated with the cells as distinguished from merely present in the medium.

It was postulated that a 1:1 complex between zinc and the dithiocarbamate ion is involved in toxicity in the first zone of inhibition, and that with increasing concentrations of the fungicide a non-toxic, 1:2, complex is formed and it is responsible for the zone of inversion growth. When trace metals were omitted from the medium in which trace sufficient and zinc sufficient cells were exposed to the fungicide, a marked zone of inversion growth occurred probably because relatively few non-toxic copper-dithiocarbamate complexes formed in the medium. This resulted in many of the toxic zinc-dithiocarbamate, 1:1, complexes inside the cells being converted to the non-toxic 1:2 complexes since more dithiocarbamate entered the cells. The data do not clarify the nature of the inhibition caused by higher concentrations of Na-DMDT (second zone of inhibition), but since response of the yeast cells is independent of the prior treatment with trace metals, it seems probable that a different mechanism of action may operate at these concentrations of fungicide, possibly one that involves depriving the fungus cells of essential trace metals through chelation or through some other effect of the DMDT ion itself. 44 pages. $2.00. Mic 58-4039

A COMPARATIVE STUDY OF SECONDARY PHLOEM OF 423 SPECIES OF WOODY DICOTYLEDONS BELONGING TO 85 FAMILIES

(Publication No. 20,432)

Mohammad Sheikh Zahur, Ph.D.
Cornell University, 1956

Supervisor: Professor H. P. Banks

The trends of phylogenetic specialization of vessel elements in the secondary xylem of woody dicots are well known. Comparable information about the evolutionary specialization of phloem in the woody and herbaceous dicots is fragmentary. A detailed study of the phloem of a large number of existing woody and herbaceous dicots should reveal the primitive type of sieve tube elements if, as in xylem, the basic trends of morphological specialization are preserved in the existing dicots.

This dissertation is a study of that kind. It is based upon the comparison of the secondary phloem of 423 species representing 85 families of woody dicots from the temperate and tropical regions. It has been possible to outline the following trends of phylogenetic specialization of the various cell types in secondary phloem:

Sieve tube elements in the secondary phloem of the woody dicots develop from the derivatives of the fusiform cambial initials. The sieve tube mother cells may divide only once before maturation or may retain meristematic activity to some extent and produce longitudinal and transverse septa. The former condition resembles more closely the limited activity found in lower vascular plants and gymnosperms. It is also significantly correlated with Polypetalae. It is, therefore, considered to represent a primitive condition.

Comparison of various characteristics, as for example, sieve tube length, length of sieve plates, number of sieve areas, length and storied or non-storied nature of cambial initials help to make the generalization that sieve tube elements in angiosperms have undergone a phylogenetic decrease in length similar to vessel elements. This decrease, however, has come about in two different ways, either by shortening of the fusiform initials or by transverse septation of the derivatives.

Concomitant with the decrease in length other evolutionary changes have occurred in the shape of sieve tube elements. There has been a gradual decrease in the length of the end walls and in the number of sieve areas on the end walls. The size of pores on the end walls, on the other hand, has increased with the evolutionary specialization of sieve tube elements. In the majority of species, sieve areas on the side walls seem to have undergone a decrease in organization with specialization of sieve tube elements. However, the significant number of exceptions does not permit any broad generalization.

The sieve tube nucleus usually breaks down completely during development of the sieve tube elements, but in some cases the breakdown is incomplete and the extruded nucleoli persist throughout the functioning activity of the sieve tube elements. In the present study this condition was found to occur in 41 species. The association of persistent nucleoli with other primitive characteristics and their occurrence in closely related families points to the primitive nature of this characteristic.

The present study makes possible the classification of the companion cells under three phylogenetic types. In the type A are included companion cells which are shorter than the sieve tube elements. They seem to represent a primitive type. Type B companion cells are as long as the sieve tube elements and differ from type C by the lack of transverse septa. Type C seems to have been derived from type B by the addition of transverse septa.

Phloem parenchyma constitutes an important part of secondary phloem. On the basis of present study, two rather distinct distributional patterns can be distinguished: 1) Irregular phloem parenchyma. In this type the parenchyma is abundant and forms a "ground tissue" in which all the other cell types are scattered irregularly; 2) Banded parenchyma. Phloem parenchyma here usually occurs in the form of wide or narrow, tangentially arranged bands which either alternate with sieve tube-parenchyma bands or, if fibers are present, occur in between sieve tube-parenchyma bands and fiber bands. At

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present, nothing can be said as to which of the two types represents the primitive condition.

Mechanical tissue, in the form of phloem fibers, fiber sclereids, sclereids and simply sclerified parenchyma constitutes an important element of secondary phloem in many woody dicots. The origin, amount and distribution of these elements vary greatly. The present comparative study has failed to throw any light on the phylogenetic origin of fibers in this tissue.

291 pages. $3.75. Mic 58-4040

CHEMISTRY

CHEMISTRY, GENERAL

ANALYTICAL APPLICATIONS OF NEAR INFRARED SPECTRA

(Publication No. 23,130)

James Harold Gibson, Ph.D.
Cornell University, 1957

Several of the absorptions occurring in the near infrared portion of the spectra have been studied to evaluate possible analytical applications. Of particular interest were the first and second overtones of the C-H stretching frequency and the O-H stretching fundamentals. The spectra in both cases were obtained on the Beckman DK-1 spectrophotometer.

Twenty some normal and branched chain aliphatic hydrocarbons were investigated to determine whether or not the C-H overtone absorptions could be used to differentiate between primary, secondary and tertiary methyl groups. The emphasis has been placed on the first overtone region and a comprehensive set of overtone assignments for these absorption bands are given for both methyl and methylene groups. Also the results of the quantitative determinations of the number of methylene, primary methyl and secondary and tertiary methyl groups per molecule are listed for aliphatic hydrocarbons. This analysis has also been extended to include such determinations in aliphatic alcohols.

The studies of the O-H absorptions included primarily those of water, alcohols and carboxylic acids. The wavelengths of the hydroxyl absorptions in primary and secondary alcohols have been carefully measured and a small difference has been noted which is satisfactory for distinguishing between the two. Results of the quantitative analyses of binary mixtures of these compounds including expected detection limits are given for several representative examples. All measurements in this region have been made using 10^{-3} to 10^{-4} molar solutions in carbon tetrachloride. 82 pages. $2.00. Mic 58-4041

THE FACTORS INFLUENCING THE FORMATION AND PROPERTIES OF LIPID-PROTEIN COMPLEXES

(Publication No. 25,260)

Krishnamurthi Ananth Narayan, Ph.D.
University of Illinois, 1957

Complexes were formed between oxidative or thermal polymers of fatty acids or glycerides and egg albumin under various conditions of pH, temperature, reaction time, lipid and protein concentration. No complex could be obtained with glycine, lysine, sodium caseinate or gelatin when reacted under similar conditions with thermally oxidized corn oil. Oxidized linoleic acid complexed with egg albumin only to the extent of 8.8% as compared with 41.4% in the case of thermally oxidized corn oil.

The state of denaturation of the protein had a pronounced effect on complex formation. The reactive groups were estimated in the native protein, the denatured protein and in the lipid-protein complexes by a technique involving acylation of these materials using lauroyl chloride. Acetylated egg albumin was also found to react with thermally oxidized corn oil and this data has been taken to indicate that the amino groups were not involved in the reactions leading to the complex formation. Nutritional experiments conducted with weanling rats showed that a pronounced decrease in the protein availability was observed only at the low protein level and particularly during the early stages of growth of the animals. A selected number of food materials and tissues were analysed for complexed lipids. Complexed lipids were found in the case of potato chips, bacon rinds and salad dressing. The nonextractable material obtained in the case of a section from a human cirrhotic liver and a section of rat epithelial tumor could not be positively identified as fatty acids.

Strongly bound oxidized lipid-alumina complexes were prepared by a simple mechanical mixing process. The lipid in these complexes could not be extracted by exhaustive solvent extraction but could be obtained by an alkali treatment. Studies on the nature of these complexes based on infra-red and thermal differential analyses, estimation of reactive groups in the lipid-protein complexes and the protein, reactions involving aldehydes and egg albumin indicated that the lipid-protein complex formation could not be explained on the basis of covalent or strong electrostatic linkages. A possible structure involving hydrogen bonding has been proposed for the complexes and has been discussed in detail. 99 pages. $2.00. Mic 58-4042

POLAROGRAPHIC STUDIES AT THE ROTATING PLATINUM ELECTRODE

(Publication No. 25,391)

Herbert Philip Silverman, Ph.D.
Stanford University, 1957

A survey was made of the polarographic behavior of some inorganic ions at the rotating platinum electrode with the purpose of determining the analytical potentialities of

this technique. Of the ions surveyed – ammonium, antimonyl, arsenite, ceric, chromic, cupric, cyanide, iodide, plumbous, manganous, molybdate, nickelous, oxalate, permanganate, sulfide, sulfite, thiocyanate, thiosulfate, stannous, and vanadate – only the following produced waves which showed analytical promise: antimonyl, ceric, chromous, cupric, iodide, plumbous, manganous, molybdate, and permanganate. Two of these ions, the permanganate and manganous ions, were studied in greater detail.

The reduction of premanganate at the rotating platinum wire electrode was studied in various media and at various pH values. A well defined cathodic wave was found in dilute sulfuric acid solutions. The electrode reaction was shown to be

$$MnO_4^- + 8H_3O^+ + 5e \longrightarrow Mn^{++} + 12H_2O.$$

The corresponding cathodic diffusion current was proportional to the concentration of permanganate ion in a concentration range between 10^{-6} to 10^{-3} M with a precision of approximately 2 percent. At higher pH values, pH 2 or greater, evidence was found of a change in the electrode reaction. It appeared that the permanganate was being reduced to manganese dioxide instead of to the manganous ion.

Application of the polarographic characteristics of the permanganate ion led to the development of an amperometric titration method for the determination of dilute solutions of oxidizable substances. Using the amperometric method, a precision and accuracy of 2% was attained in the determination of ferrous ion at the 10^{-4} M concentration level and a precision and accuracy of 5% was attained at the 10^{-6} M concentration level. Abnormally large errors were observed in the titration of very dilute solutions. The magnitude of the error was found to be a function of the initial concentration of the reducing agent and the type of anion present. This was explained by postulating a parasitic reaction between permanganate and water.

The anodic oxidation of the manganous ion to manganese dioxide at the rotating platinum electrode was also studied in various media and at various pH values. At room temperature the diffusion current was not proportional to concentration. However, at an elevated temperature, 46° C, a linear relationship between diffusion current and concentration was found. In a sulfate buffer of pH 2.2, the diffusion current was proportional to concentration in the range 3×10^{-5} to 2×10^{-4} M. In an acetate buffer at pH 5.0 the diffusion current was proportional to concentration in the range 7×10^{-6} to 4×10^{-4} M. Manganous ion could be determined with an accuracy and precision of 1 to 2 percent in these regions.

The polarographic wave of the manganous ion was found to be dependent upon the type of buffer, the concentration of the buffer, and the buffering capacity of the solution. The height of the diffusion current at any particular pH was found to be an inverse function of the concentration and complexing power of the buffer and a direct function of its capacity to absorb hydrogen ions.

Cathodic dissolution patterns of manganese dioxide were presented. From these, the standard potential of the electrode reaction was calculated to be 1.30 volts vs. N.H.E. 124 pages. $2.00. Mic 58-4043

CHEMISTRY, ANALYTICAL

I. THE QUANTITATIVE DETERMINATION OF MERCAPTANS IN GRAIN BEVERAGES. II. THE APPLICATION OF MICRO-X-RAY DIFFRACTION ANALYSIS TO PAPER CHROMATOGRAPHY.

(Publication No. 25,235)

Emmett Frank Kaelble, Ph.D.
University of Illinois, 1957

I

The formation of an objectionable odor in grain beverages such as beer upon exposure to light has been observed for many years. This "sunstruck" flavor is generally attributed to mercaptans, though the specific compounds involved and the mechanism of their formation are obscure. In this investigation, quantitative objective methods of mercaptan analysis were sought to replace the subjective organoleptic response commonly used in this complex system.

Two amperometric methods were investigated: mercurimetric titration in borax buffer and argentimetric titration in tris (hydroxymethyl)aminomethane. The rotated platinum electrode served as indicator electrode. Both titrations were found to be accurate and reproducible when applied to reduced glutathione and ethyl thioglycolate. Furthermore, these compounds were quantitatively recovered when added to beer.

Special procedures are described for the application of the titrations to beer. A definite increase in the mercaptan content of beer upon irradiation with daylight fluorescent light was observed with both titrations. Experiments with series of samples irradiated for different periods showed the rate of the photochemical reaction to decrease with increasing time of irradiation.

Although both titrations showed corresponding increases in the sulfhydryl content of beer upon irradiation, consistently higher end-points were obtained with the mercurimetric technique. It was demonstrated that sulfite, normally present in small amounts in beer, interferes with the mercurimetric titration but not with the argentimetric.

Because of sulfite interference, the mercurimetric technique cannot be used to determine absolute sulfhydryl concentrations in beer, although it is useful in following changes which occur upon irradiation. The argentimetric titration apparently is specific for sulfhydryl groups and has the added advantage of yielding more nearly linear titration curves than does the mercurimetric method. The sulfhydryl content of a typical beer was shown to increase from 2 parts per million before irradiation to 45 parts per million after 30 minutes irradiation.

The spectrophotometric methylene blue method of sulfhydryl analysis was investigated and found unsatisfactory. Under the conditions used, the reduction of sulfur to hydrogen sulfide by sulfhydryl groups, upon which the method depends, did not proceed quantitatively. In experiments with ethyl thioglycolate, the maximum recovery achieved was 12 per cent.

II

The use of x-ray diffraction to identify components of mixtures after separation by paper chromatography was investigated. Complications arising from crystal

interferences of cellulose were eliminated by the use of glass fiber paper.

Lead glass capillaries were used rather than conventional pinhole systems to collimate the x-ray beam, since they produced more intense, more sharply defined beams. They permitted the identification of microgram quantities of various compounds suspended on glass fiber paper. The limit of detection for amino acids was 50 micrograms; for simple inorganic compounds, 10 micrograms.

Impregnation with silicic acid was necessary to render glass fiber paper suitable for chromatography. This was done by treating it with a hydrous silica sol prepared by passing sodium silicate solution through cation exchange resin.

Small-angle scattering of x-rays by the colloidal silicic acid interfered with the identification of compounds suspended on impregnated glass fiber paper. Thus, application of the direct identification of compounds on paper by x-ray diffraction is limited to certain electrophoretic separations in which untreated glass fiber paper can be used.

A technique found to be more generally applicable, simpler, more sensitive, and independent of paper type involves extraction of separated components from chromatograms before x-ray identification. Diffraction patterns are taken with the extracted material mounted directly over the opening of a lead glass capillary beam collimator. 148 pages. $2.00. Mic 58-4044

CHEMISTRY, BIOLOGICAL

STUDIES ON THE ANALYSIS AND PERSISTENCE OF 3-AMINO-1,2,4-TRIAZOLE IN PLANT TISSUE AND SOIL

(Publication No. 25,081)

Charles Drago Ercegovich, Ph.D.
The Pennsylvania State University, 1957

Because 3-amino-1,2,4-triazole (aminotriazole) produces unique physiological responses in plants and is becoming an important herbicide for the control of perennial weeds and grasses, studies of its behavior toward crops and in soil are of considerable practical significance. The objects of this investigation were to ascertain whether or not corn grown in aminotriazole-treated soils absorbed and stored this compound, and in addition, to determine the effects of various factors on persistence of this compound in treated soil.

In order to determine the fate of aminotriazole in soil, investigations were conducted to evaluate the effects of temperature, pH and moisture on the disappearance of aminotriazole in Hagerstown silt loam soil.

Since these studies depended almost entirely on analytical data, considerable time was spent investigating and modifying the methods currently available so that they would yield accurate, reproducible results. The method developed and employed for the analysis of aminotriazole in plant tissue is as follows: aminotriazole is separated from a methanol extract of plant tissue by means of Amberlite IR-120 cation exchange resin. The compound is then eluted from the cation resin with ammonium hydroxide. Removal of interfering plant material is accomplished by adsorption of these impurities on Dowex 1-X4 anion exchange resin. The purified effluent is then reacted with sodium nitroprusside, producing a grassy green color, which is measured in a photoelectric colorimeter.

The procedure employed for analysis of aminotriazole in soil is a modification of that of Sund (2). A significant improvement of this method had been developed for soils containing large amounts of organic matter. With such soils it is not possible to extract the aminotriazole with distilled water alone because of the large amount of interfering materials extracted by the water. To avoid this difficulty it was found that a saturated solution of barium hydroxide yielded extracts free of interfering materials. After removing the barium ion from the extract by precipitating with sulfuric acid, the aminotriazole is determined as already outlined for the analysis of aminotriazole in plant tissue.

Quackgrass plants sprayed with aminotriazole absorbed the compound – presumably through the leaves – in a few hours. The amount taken up was in general proportional to the amount applied. The amounts of aminotriazole in the plant decreased with time after application, the maximum loss being of the order of 90 per cent in 15 days. It was not possible to establish with certainty the mechanism of this loss, but it is suggested that chemical combination with the compound in the plant and leaching may account for most of it.

An extensive series of samples were taken of corn planted in soil treated with aminotriazole throughout the growing season. Chemical analysis of these samples failed to reveal any measurable residue of the compound in corn tissue at any time. The maximum rate of application was eight pounds of aminotriazole per acre, and in one case, corn was planted one day after application of the compound. Similarily, analysis of samples of radish, bean and spinach plants grown in soil treated with aminotriazole failed to show measurable amounts of the compound.

In vitro experiments with Hagerstown silt loam soil showed that the rate of disappearance of aminotriazole from the treated soil is a function of temperature, at least up to 100° C. At 20° C., chemical analyses showed complete disappearance of the compound in 144 hours. It is suggested from X-ray diffraction studies made on the clay fractions of this soil that aminotriazole may form complexes with compounds present in soils. Soil microorganisms and chemical decomposition may also play a part in this disappearance.

Raising or lowering of the pH of Hagerstown silt loam soil from its normal value of 7.0 speeded up the disappearance of aminotriazole when this compound was added to the soil.

There was found to be a direct correlation between the amount of moisture and the rate of disappearance of aminotriazole from treated soil: when the soil contained 30 per cent moisture the disappearance of aminotriazole was complete in six days. It appears probable that the presence of larger amounts of moisture favor physical, chemical and biological reactions which would tend to reduce the amount of the compound.

63 pages. $2.00. Mic 58-4045

THE BIOGENESIS OF CHOLESTEROL IN NORMAL AND BIOTIN DEFICIENT RATS

(Publication No. 24,163)

Gert Max Jacobsohn, Ph.D.
Purdue University, 1957

Major Professor: Ralph C. Corley

The role played by β,β-dimethylacrylic acid (DMA) as a direct precursor of cholesterol has been reexamined by the use of biotin depleted rat livers. Two groups of weanling white male rats were kept on laboratory diets prepared from purified materials. The composition was: Sucrose 66%, protein 20%, fat (Crisco) 10%, salt mixture No. 2, 4%. The protein constituent consisted of casein in the normal diet, and of dried raw egg white in the biotin deficient ration. A suitable vitamin supplement was added to each diet. Animals on the egg white mixture showed symptoms of the deficiency after three weeks. Some deficient rats succumbed to the lack of biotin during the sixth week of the feeding period.

The animals were sacrificed at a time when the severity of the deficiency was manifestly visible. The livers were excised, cut into slices and incubated in Krebs-Ringer phosphate buffer. The substrate consisted of either sodium acetate-2-C^{14} or of DMA-1-C^{14}. Cholesterol was isolated from the unsaponifiable matter by precipitation with digitonin. The digitonide complexes were dissolved in pyridine. The cholesterol was extracted with ether, plated on aluminum planchets and counted in a gas-flow instrument.

In comparison with normal rat liver slices, the deficient slices incorporated more acetate but less DMA into cholesterol. The overall cholesterogenic ability from radio-acetate was not impaired in the deficient rat livers but radio-DMA could be utilized only at an exceedingly low rate for sterol formation. The data indicate that DMA does not seem to lie in the main pathway from acetate to cholesterol and that it is not an obligatory precursor of cholesterol from acetate. The reversible carboxylation that occurs when DMA is converted to β-hydroxy-β-methylglutaric acid (HMG) is known to be under the influence of biotin. Present experiments tend to show that DMA can be utilized only after its carboxylation to a six-carbon compound. It is likely that such a compound, perhaps trans-methylglutaconic acid, condenses with itself directly and thereafter loses CO_2 to produce, ultimately, squalene. The latter produces cholesterol through a series of transformations.

Livers from rats which were starved for 96 hours were incubated, in the same manner as described previously, with radio-acetate and radio-DMA. With either substrate, the activity of the isolated cholesterol was exceedingly low. Not only was the conversion of acetate to cholesterol practically stopped, but the transformation of DMA was similarly almost nil. These experiments indicate that the results obtained with the other animals of this study were not due to a voluntary limited food intake.

A number of incubations were performed on normal and deficient rat livers with the addition of unlabeled DMA or of unlabeled HMG. Sodium acetate-2-C^{14} was the uniform substrate in all of these determinations. The results demonstrate that both DMA and HMG caused a decreased incorporation of radio-acetate into cholesterol in the normal and biotin deficient states. The cause for the decreased conversion of acetate to cholesterol seems for two reasons to be due to an actual enzymatic inhibition. First, in deficient livers the inhibitory effect of DMA was greater than that of HMG. These livers had been shown before to incorporate DMA into cholesterol only to a very slight extent. Second, the deficient liver preparations had a greater ability to synthesize cholesterol from acetate than normal livers. Such a finding would suggest that the inhibitory effect of HMG should be greater in normal livers because they have a smaller metabolic pool or a higher rate of turnover relative to deficient livers. No difference in inhibitory effect of HMG was noticed between the two sets of animal livers.

The cholesterol content of liver was found to be 0.21± 0.02% of the wet weight for normal and 0.19 ± 0.02% for biotin deficient rats. 141 pages. $2.00. Mic 58-4046

CHEMICAL STUDIES OF INFLAMMATORY EDEMA, EXPERIMENTALLY INDUCED

(Publication No. 24,909)

Carl Laden, Ph.D.
Northwestern University, 1957

Experimental inflammatory edema was induced by injecting an irritant solution into the pleural cavity of rats. The volume of fluid found in the pleural cavity after a specified time interval was used as a measure of the degree of inflammation produced.

Treating the rats with bile, cholic acid or desoxycholic acid lessened the amount of edema formed. Desoxycholic acid was found to be an effective anti-inflammatory agent in adrenalectomized rats. Oxidized derivatives of these bile acids had little or no anti-inflammatory activity.

The effect of counter-irritants on reducing pleural edema was studied. Injection of irritants into the knee joint of the rat was found to reduce the amount of edema formed. $AgNO_3$ was found to be very active in this respect. The anti-inflammatory effect observed could not be explained by loss of fluid into the injected knee, nor by stimulation of the pituitary-adrenal axis. The effect was still present in hypophysectomized rats and adrenalectomized rats. The use of plaster casts to prevent fluid loss into the injected leg did not block the reduction in pleural edema. Analyses were made of edema fluid and serum protein concentrations, hematocrits, and osmolality in an effort to gain some insight into the mechanism of action of counter-irritants.

Using $AgNO_3$ as the counter-irritant, it was found that blood from rats injected with $AgNO_3$ exhibited activity in reducing pleural edema when injected into untreated rats. This was true even when the $AgNO_3$ treated rats, which served as blood donors, had been previously hypophysectomized and adrenalectomized. Initial attempts to characterize the substance in the blood responsible for the anti-inflammatory activity were unsuccessful.

It was suggested that counter-irritants release some substance or substances from the tissues which they damage, which is then carried by the blood and can exert an anti-inflammatory effect in another part of the animal.

121 pages. $2.00. Mic 58-4047

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STUDIES ON A LIPOIC ACID-ACTIVATING SYSTEM

(Publication No. 25,166)

Franklin Rollin Leach, Ph.D.
The University of Texas, 1957

Supervisor: Dr. L. J. Reed

Cell-free extracts of lipoic acid-deficient Streptococcus faecalis (10C1) have been obtained which catalyzed a dismutation of pyruvate and α-ketobutyrate provided the extracts were preincubated with lipoic acid. During the preincubation lipoic acid was converted to an enzymatically active, protein-bound form.

Dialysis of the crude extract against 0.6 per cent ethylenediaminetetraacetate in 0.02 M tris(hydroxymethyl)aminomethane buffer (pH 7.4) prior to incubation with radioactive lipoic acid revealed that both a divalent metal ion (Mg^{++} or Mn^{++}) and inorganic phosphate were required for "binding" of lipoic acid and enzymatic activity.

Fractionation of the crude extract with protamine sulfate yielded a protamine precipitate fraction, which contained the apo-pyruvate dehydrogenation system, and a protamine supernatant fraction, which contained a lipoic acid-activating system. Both enzyme fractions had to be incubated simultaneously with lipoic acid to obtain an active pyruvate dehydrogenation system. After these two fractions were purified further by ammonium sulfate fractionation, it was necessary to include adenosine triphosphate (ATP) in the incubation mixture. A lipoic acid-activating system was detected also in protamine fractionated E. coli extracts.

The lipoic acid-activating system from S. faecalis was separated into two essential components by fractionation with alkaline ammonium sulfate. One of these components, fraction PS-2A, produced lipohydroxamate when incubated with lipoic acid, ATP, and hydroxylamine. The other component, fraction PS-2B, was heat-stable, non-dialyzable, and was inactivated by treatment with proteolytic enzymes. In the preincubation mixture lipoic acid and ATP, but neither fraction PS-2A nor fraction PS-2B, could be replaced by synthetic lipoyl adenylate.

The reaction sequence shown below is tentatively proposed to represent the conversion of lipoic acid to the "bound" form which is an integral part of the pyruvate dehydrogenation system. It is suggested that fraction PS-2A activates the carboxyl group of lipoic acid through formation of lipoyl adenylate, which appears to be enzyme-bound (reaction 1). It is postulated that fraction PS-2B functions as a lipoyl carrier (reactions 2 and 3). Reaction 3 represents the incorporation of the lipoyl moiety into the apo-pyruvate dehydrogenation system, presumably as lipoyl-enzyme.

(1) E_1 + ATP + lipoic acid $\rightleftharpoons$ E_1-lipoyl-AMP + PP

(2) E_1-lipoyl-AMP + E_2 $\rightleftharpoons$ lipoyl-E_2 + AMP + E_1

(3) Lipoyl-E_2 + A-PDS $\longrightarrow$ lipoyl-A-PDS + E_2

E_1 = fraction PS-2A

E_2 = fraction PS-2B

A-PDS = apo-pyruvate dehydrogenation system

91 pages. $2.00. Mic 58-4048

SUBSTRATE CLEAVAGE POINTS OF SOME CARBOHYDRASES AS DETERMINED BY O^{18} STUDIES

(Publication No. 25,249)

Frederick Charles Mayer, Jr., Ph.D.
University of Illinois, 1957

Maltose has been shown to contain one exchangeable oxygen position. This was demonstrated by equilibrating maltose and H_2O^{18} and then determining the decrease in the O^{18} content of the water.

A method for the determination of the O^{18} in the C-1 position of sugars has been devised. The procedure was as follows: Known amounts of O^{18}-labelled sugar and O^{16} water were equilibrated in a sealed tube and the O^{18} content of the water was determined. From the mmol. -CHO (sugar) and the mmol. water equilibrated and from the O^{18} content of the water, the O^{18} content of the sugar was calculated from simple isotope dilution. The method has been termed Back-equilibration.

The hydrolysis of glycogen dissolved in H_2O^{18} by β-amylase was investigated. The maltose produced as a result of enzyme action was analyzed for O^{18} and was found to contain approximately 90 per cent of the theoretical amount in the C-1 position.

The action of hog pancreatic amylase on glycogen in O^{18} water was studied. The sugars produced were analyzed for O^{18}. The amount of isotope in the sugars was approximately 90 per cent of the theoretical value. Hog pancreatic amylase cleaved the glucosidic bond between the C-1 carbon and the oxygen of the bridge.

The cleavage point of Bacillus subtilis amylase has been studied utilizing glycogen as substrate and O^{18} as a tracer. Analysis for O^{18} in the sugars produced showed 90 per cent incorporation into the C-1 position. The α-1,4 glucosidic linkages were ruptured at the C-1 side of the oxygen bridge.

Limit dextrin hydrolysis by amylo-1,6-glucosidase has been investigated using O^{18} as a tracer. The glucose resulting from enzyme action contained isotope. Although the incorporation of isotope was low (around 34 per cent), the preliminary results indicate that the enzyme cleaved the α-1,6 glucosidic bond on the aldehyde side of the oxygen bridge.

The results of these investigations have been discussed in terms of the chemical behavior of polysaccharides and also in terms of Koshland's proposals concerning the mechanism of enzyme action.

57 pages. $2.00. Mic 58-4049

ANTIBIOTIC SUBSTANCES FROM YEAST

(Publication No. 25,405)

Werner Motzel, Ph.D.
Institutum Divi Thomae, 1956

Yeast was extracted with alcohol and acetone by various procedures. The active material was adsorbed on charcoal, and the effective charcoal eluate separated into a very active ninhydrin-negative and a non-effective ninhydrin-positive fraction by use of cellulose column

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chromatography. The effective fraction has pH 4 and was further purified by fractional ether extractions at various pH ranges. A correlation was found between the bactericidal factors and a newly developed fluorescing spot on paper chromatograms. To make the spots visible, the developed chromatograms have to be sprayed with an ammonium hydroxide solution. The color vanishes as soon as the ammonia is evaporated. Further investigations revealed that, by using different solvents, the effective material was split up into two substances, which showed up on paper chromatograms as two closely approximated yellow fluorescing spots (Y1, Y2).

By use of strip chromatogram techniques these two substances were separated and obtained in pure form. Both materials showed similar strong inhibition against Staphylococcus aureus. Chromatographic analysis of hydrolysates revealed that both substances were peptides. By use of the two dimensional techniques the following amino acids were identified in Y1: valine, leucine, alanine, glycine, and glutamic acid. Y2 contained the same amino acids and γ-aminobutyric acid in addition. Electrophoretic studies as well as end group determinations revealed the absence of free amino groups in Y1 and Y2 and the presence of a free carboxyl group in Y1.

The results suggest a cyclic structure for both substances. In the case of Y1 the free carboxyl group has to come from the glutamic acid. In the case of Y2, infrared and ultraviolet spectrograms suggest that the γ-aminobutyric acid is bound with its amino group to the free carboxyl group of the glutamic acid and forms a lactam. The basic ring structure of both substances seems to be the same. 113 pages. $2.00. Mic 58-4050

ANTISTAPHYLOCOCCIC FACTORS IN BRAIN EXTRACT

(Publication No. 25,406)

Guenter Schramm, Ph.D.
Institutum Divi Thomae, 1956

Crude brain extract is very effective in the prevention and treatment of Staphylococcus aureus infections in mice. Investigations on the concentration and characterization of the active factors in the extract are reported. The effectiveness of the fractions was evaluated in terms of the dose which protected mice from death by S. aureus infection, using a combined prophylactic-therapeutic procedure.

Ion exchange operations increased the activity of brain extract 10-fold. The behavior of the active principle on different ion exchange resins suggested an amphoteric nature. Paper chromatography of the active ion exchange fraction revealed the presence of a number of amino acids and peptides with γ-amino-butyric acid as main constituent. Animal assays indicated that the amino acids and peptides in the extract are not responsible for the activity.

A number of organic acids were demonstrated in brain extract by paper chromatography. Extraction of the acids yielded a fraction with a 40-fold increase in biological activity. Re-extraction of the acid fraction produced a 90-fold increase in the fraction extracted at pH = 4.5. Separation of this highly active fraction by paper strip chromatography gave 10 different fractions. In vitro tests by the filter disc method showed growth inhibition of S. aureus in two fractions, containing two unknown organic acids. 106 pages. $2.00. Mic 58-4051

STUDIES ON THE STRUCTURE OF NEAMINE

(Publication No. 25,281)

Paul Dale Shaw, Ph.D.
University of Illinois, 1957

The hydrolysis of neomycin B and neomycin C was investigated in an attempt to identify the pentose fragment present in the neobiosamine portion of the molecule. It was found that conditions sufficiently vigorous to cleave the neobiosamine nearly completely degraded the pentose.

Neamine and several of its derivatives were prepared and their properties investigated.

Neamine was oxidized with periodate. The degradation fragments included two moles of formic acid, two moles of ammonia, no formaldehyde, and three larger fragments which contained intact desoxystreptamine.

N,N',N'',N'''-Tetraacetylneamine was oxidized by periodate under a variety of conditions. The reaction with 0.01M periodate and 0.1M periodic acid was not selective. The reaction with 0.1M sodium periodate proceeded with the reduction of two moles of the reagent. The resulting aldehyde was oxidized to the corresponding acid, and this material was hydrolyzed to give three fragments, one of which appeared to be glycine and another seemed to be an acidic amino acid. No formaldehyde or formic acid was produced by 0.1M periodate reaction.

The oxidation of neamine with lead tetraacetate was not selective. N,N',N'',N'''-Tetrabenzoylneamine reduced two moles of tetraacetate slowly, and the resulting aldehyde gave the corresponding acid on oxidation with potassium permanganate. 139 pages. $2.00. Mic 58-4052

PHOSPHORYL-COENZYME A, AN INTERMEDIATE IN ENZYMATIC SUCCINYLATION OF DIHYDROLIPOIC ACID

(Publication No. 25,286)

Roberts Angus Smith, Ph.D.
University of Illinois, 1957

Succinyl-S-CoA formation by extracts of Escherichia coli has been shown to occur by the following reactions:

$$\text{ATP} + \text{CoASH} \rightleftharpoons \text{CoA-S-P} + \text{ADP} \quad \text{------(1)}$$

$$\text{CoA-S-P} + \text{Succinate} \rightleftharpoons \text{Succinyl-S-CoA} + \text{iP} \quad \text{------(2)}$$

Reaction 1 is catalysed by CoA thiolkinase which has been purified about 40 fold from extracts of E. coli. This reaction can be assayed spectrophotometrically with catalytic amounts of ATP by coupling pyruvic kinase and lactic dehydrogenase to CoA thiolkinase in the presence of substrate levels of phosphoenolpyruvate, CoASH, and DPNH.

$$\text{PEP} + \text{CoASH} + \text{DPNH} + \text{ATP} \rightleftharpoons \text{ATP} + \text{DPN} + \text{CoA-S-P} + \text{Lactate} \quad \text{----(3)}$$

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In addition to the convenient assay, reaction 3 provides a means of accumulating CoA-S-P nearly free of ATP. Destruction of the enzymes by boiling for two minutes at pH 7.3 leaves CoA-S-P available for further enzymatic study. Reaction 2 is catalysed by phosphoryl-succinic-thiophorase which has been purified about 10 fold from extracts of E. coli. Pantetheine will react in place of CoASH in these reactions at a rate about one tenth that of CoASH.

The complete system, termed succinic thiokinase, in common with Kaufman's spinach P enzyme, (Kaufman, S., J. Biol. Chem., 216, 153, 1955) catalyses the reaction summarized in equation 4.

$$ATP + succinate + CoASH \rightleftharpoons Succinyl\text{-}S\text{-}CoA + ADP + iP \quad (4)$$

Reaction 4 can be assayed by the chemical reaction of succinyl-S-CoA with hydroxylamine and the resulting succinyl hydroxamate measured by its reaction with ferric ions.

Lipoic transsuccinylase, which catalyses reaction 5

$$Succinyl\text{-}S\text{-}CoA + lip(SH)_2 \rightleftharpoons Succinyl\text{-}S\text{-}lip\text{-}SH + CoASH \quad (5)$$

can be enzymatically coupled to reaction 4, resulting in the succinyl-S-CoA mediated formation of 6-S-succinyl-6, 8-dithioloctanoic acid. Lipoic transsuccinylase has been purified about 10 fold from extracts of E. coli. The importance of the reactions described is discussed in relation to α-ketoglutarate oxidation.

99 pages. $2.00. Mic 58-4053

STUDIES ON THE FACTORS THAT INFLUENCE THE ACETYLATING ACTIVITY OF BLOOD

(Publication No. 24,928)

Devaguptapu Subrahmanyam, Ph.D.
Northwestern University, 1957

Acetylating activity in mammalian blood was determined according to the method of Blondheim (Arch. Biochem. and Biophys. 55, 365 (1955)). N-Acetyl-para-aminobenzoic acid was identified in human blood incubated with para-Aminobenzoic acid (PABA) for 24 hours at 37°C by a paper chromatographic method.

The extent of acetylation of added PABA in heparinized whole blood from 5 different species in fasting state was studied. Rat blood was found to acetylate about 15% of the added PABA while that of rabbit acetylated up to 20%. Guinea pig blood exhibited similarity to rabbit blood in its acetylating activity. Human blood, under the conditions of the experiment, possessed maximum acetylating capacity of about 27%. Dog blood, however, failed to show any acetylating activity. 70% of the acetylation was found to occur in the blood of these species during the first 12 hour incubation period.

The optimum temperature for the acetylation reaction was found to be 37°C and the amount of PABA acetylated appeared to be independent of the initial substrate concentration. Blood did not exhibit any deacetylating activity because the amount of acetyl-PABA added was recovered quantitatively at the end of the incubation period.

The enzymes systems involved in the acetylation reaction appeared to be confined to the cellular components while plasma served as a source of acetate or some precursor of acetate. The acetylation was found to reach a maximum in 24 hours coincident with the complete disappearance of glucose from the blood thereby suggesting that the energy for the acetylation reaction might be derived from the metabolizing glucose. Addition of glucose markedly stimulated the extent of acetylation by rat blood while fructose and galactose showed a less favorable effect. Sucrose, lactose and maltose did not alter the normal acetylation values.

2,4-Dinitrophenol and citrate reduced the acetylation when used at fairly high concentrations while fluoride and nembutal markedly inhibited acetylation at low concentrations.

Studies on the effect of vitamin deficiency on the acetylation by rat blood showed that avitaminosis in thiamine, riboflavine, niacin, pantothenic acid, biotin and pyridoxine led to decreased acetylation. Supplementing the thiamine deficient rat blood, with cocarboxylase, niacin deficient rat blood with Co.I (D.P.N) or Co.II (T.P.N), and pantothenic acid deficient rat blood with pantothenate or Co.A restored the acetylation values to near normal. Acetylation by normal rat blood was not significantly altered in presence of the added vitamins or coenzymes. Deficiency in choline also led to a slight inhibitory effect on the acetylation by rat blood. Further, scorbutic guinea pig blood was found to acetylate less PABA as compared to normal blood. Deficiency in vitamin B_{12} and folic acid did not show significant influence on the normal acetylating activity of rat blood.

No appreciable alteration in the normal blood acetylation values was observed on feeding rats with diet rich in fat.

It was concluded from the results that factors that effect the liberation of energy or influence the formation of certain coenzymes involved in the carbohydrate metabolism and acetyl groups have a modifying effect on acetylation.

The studies presented here indicate that most of the factors that effect the acetylation of aromatic amines by liver seem to influence in a similar way the acetylation by blood. This suggests that the same enzyme systems that acetylate in liver may be present in blood cells. The few differences observed are, perhaps, more due to the different types of tissues in which acetylation was conducted rather than the different nature of their enzyme systems.

96 pages. $2.00. Mic 58-4054

THE DISTRIBUTION AND METABOLISM OF DI- AND POLYAMINES IN MICRO-ORGANISMS

(Publication No. 25,342)

Robert Hinchman Weaver, Ph.D.
University of Maryland, 1957

Supervisor: Dr. Edward J. Herbst

Hemophilus parainfluenzae requires one of several di- and polyamines for growth. These compounds include putrescine, 1,3-propanediamine, spermidine, and spermine. Techniques, involving steam distillation, paper electrophoresis, and colorimetric estimation of amines, were developed for analysing relatively small amounts of material for these compounds. These techniques were used to study the distribution and metabolism of H. parainfluenzae growth factors in micro-organisms.

In general, gram-negative bacteria contain putrescine and somewhat smaller concentrations of spermidine. Most gram-positive bacteria contain only traces of these compounds. Spermine and spermidine are the predominant compounds in yeast and molds, but these organisms contain small amounts of putrescine and 1,3-propanediamine. The di- and polyamine content of mammalian liver is similar to that of yeast.

These techniques were also used to study amine interconversion in micro-organisms. H. parainfluenzae degrades spermine and spermidine to 1,3-propanediamine during growth. N-(4-aminobutyl)-1,4-butanediamine, another growth factor for this organism, is degraded to putrescine, but another active polyamine, N-(3-aminopropyl)-1,3-propanediamine, is not broken down during growth. Similar amine degradations were observed with Neisseria perflava, an organism to which these compounds are growth-stimulatory. Evidence was obtained which indicates that some other microorganisms also metabolize polyamines by this pathway.

The polyamine-degrading enzyme is adaptive in both H. parainfluenzae and N. perflava. Using a sonic extract of spermine-adapted N. perflava cells, the basic properties of the enzyme system were investigated. The enzyme is apparently a typical amine oxidase and the activity was measured manometrically. It has an optimum pH of 7.0 and is inhibited by carbonyl reagents. None of a large number of mono- and diamines was oxidized by the enzyme. The substrate must contain a four carbon diamine unit which is N-aminoalkyl-substituted. Indirect measurements, involving a coupling of this enzyme system to a peroxidase system in order to prevent oxygen release from hydrogen peroxide by endogenous catalase activity in the cell extract, indicate that one mole of oxygen is consumed per mole of spermine or spermidine oxidized. One mole of 1,3-propanediamine is produced from one mole of either polyamine. The other product of spermidine degradation may be Δ^1-pyrroline, and the other product of spermine oxidation has been tentatively identified as N-(3-aminopropyl)-Δ^2-pyrroline. The role of this enzymatic degradation in the metabolism of these organisms is not clear, but its possible function as a detoxication mechanism is discussed.

Although H. parainfluenzae shows a strict amine requirement, putrescine is synthesized during growth. This was shown by measuring the dilution of C^{14}-labeled putrescine by growing cells. The possibility that these compounds function in a regulatory manner in H. parainfluenzae metabolism is discussed.

56 pages. $2.00. Mic 58-4055

CHEMISTRY, INORGANIC

THE PREPARATION AND PROPERTIES OF METAL MANGANATES (VI)

(Publication No. 25,013)

Carl Kenneth Bjork, Ph.D.
University of Kentucky, 1953

Associate Professor: William F. Wagner

A literature survey was made of published articles describing the preparation and properties of the manganates (VI).

The preparation of potassium manganate by oxidation of the manganese (II) ion, using the method reported by Thompson, Ockerman, and Schreyer[1] for the production of ferrates, resulted in precipitation of hydrated manganese dioxide, and a dark green-colored potassium manganate solution. No crystals of potassium manganate could be obtained from the solution.

Crystalline potassium manganate was prepared by boiling a solution of potassium permanganate in concentrated potassium hydroxide. When these crystals were purified by a modification of the method developed by Thompson, Ockerman, and Schreyer[2] for the purification of ferrates, potassium manganate of purity better than 95% was obtained. An iodometric method of analysis was developed which gave results of satisfactory precision.

Spectral absorption curves of potassium manganate dissolved in aqueous potassium hydroxide solutions, as determined on a Beckman Model DU Spectrophotometer, indicated a minimum in transmittancy at 355 and 435 millimicrons and a maximum transmittancy at 500 millimicrons. Further work also showed that a potassium manganate solution in 3 M potassium hydroxide conforms to Beer's law for concentrations ranging from 0.386g/liter to 1.872g/liter.

After a spectrophotometric method of analysis was developed, a spectrophotometric study was made of the decomposition of potassium manganate in 6 M, 3 M, 1 M, 0.5 M, 0.25 M, 0.1 M, and 0.05 M potassium hydroxide solutions over a three hour period. Decomposition of the manganate was noted in all solutions except the one in 6 M hydroxide. Permanganate was one of the decomposition products in the 0.25 M, 0.1 M, and 0.05 M hydroxide solutions. The potassium manganate concentration of these solutions which indicated the presence of potassium permanganate was determined by the algebraic method for analysis of a two component system[3], while the concentration of manganate in the remainder of the solutions was determined directly from the analytical working curve.

When the potassium manganate crystals were placed in water, a red-purple solution was obtained which showed very little transmittancy at various wave lengths over the entire visible range. This effect was attributed to the presence of a gel of hydrated manganese dioxide in the solution which scattered the light rays.

Addition of potassium manganate crystals to dilute hydrochloric acid immediately gave a purple-colored permanganate solution and precipitated hydrated manganese dioxide. A spectrophotometric study of this permanganate solution indicated the disproportionation of the manganate to permanganate and manganese dioxide is complete in the acid medium.

A solution of sodium manganate was prepared by the action of sodium perchlorate on alkaline potassium manganate, but no crystals of sodium manganate were obtained.

Rudidium manganate of 87% purity and cesium manganate of over 97% purity were precipitated as a result of the addition of sodium manganate solution to a concentrated solution of the corresponding hydroxide. The rubidium and cesium hydroxides were prepared by the addition of barium hydroxide octahydrate to the alkali sulfates.

The preparation of barium manganate by the reaction of a solution of potassium manganate in 1 M potassium hydroxide and a saturated solution of barium hydroxide yielded a product with a purity of 76%. When a dilute solution of barium nitrate was used as the source of barium ions, barium manganate of over 83% purity was obtained. With solid barium nitrate, an 88% pure product was precipitated. A slurry of barium nitrate added to the alkaline potassium manganate yielded barium manganate which was 90% pure. In the final attempt, where finely powdered barium acetate monohydrate was used, barium manganate with an analyzed purity of 92% resulted.

Preparation of strontium manganate by the action of strontium acetate on an alkaline potassium manganate solution gave an impure, turquoise-colored precipitate which analyzed about 50% $SrMnO_4$.

80 pages. $2.00. Mic 58-4056

1. Thompson, C. W., Ockerman, L. T., and Schreyer, J. M., J. Am. Chem. Soc., 73, 1379 (1951).

2. Ibid.

3. Mellon, M. G., "Analytical Absorption Spectroscopy; Absorbimetry and Colorimetry," Wiley, New York, 1950, p. 369.

I. THE STRUCTURE AND PROPERTIES OF TETRAALKYL-2-TETRAZENES. II. SOME SUBSTITUTION REACTIONS OF TRIMERIC PHOSPHONITRILIC CHLORIDE.

(Publication No. 25,198)

William Earnest Bull, Ph.D.
University of Illinois, 1957

PART I

Tetramethyl-2-tetrazene was prepared by the oxidation of unsymmetrical dimethylhydrazine with mercuric oxide. Tetramethyl-2-tetrazene is a basic substance and forms salts which are unstable toward hydrolysis and heat. It forms coordination compounds with heavy metal ions; the tetramethyl-2-tetrazene mercuric bromide complex is monomeric in benzene and a nonconductor in ethanol.

Tetramethyl-2-tetrazene has been shown by a spectrophotometric procedure to be produced by the incomplete oxidation of dimethylhydrazine with a variety of oxidizing agents. Autoxidation of dimethylhydrazine has been shown to produce the corresponding 2-tetrazene.

Reduction of tetramethyl-2-tetrazene in liquid ammonia required four moles of sodium, but no produce could be isolated from the reduction mixture.

Tetramethyl-2-tetrazene and tetraethyl-2-tetrazene were found to give ultraviolet absorbancy maxima at 277 mμ and 285 mμ in ethanol with molar absorptivities (a_M) of 8.3×10^3 and 5.4×10^3, respectively. The absorbancy maxima of tetraalkyl-2-tetrazenes were found to shift to higher frequencies as more protonic solvents were employed. This property was utilized to determine a value of 5.13 for the pK_b of tetraethyl-2-tetrazene.

The characteristic infrared absorption spectra of several tetraalkyl-2-tetrazenes, their derivatives, and related compounds were obtained and group absorption frequencies were assigned. The absorption bands occurring at 1450 cm^{-1} and 1438 cm^{-1} in the spectrum of tetramethyl-2-tetrazene are assigned to the -N=N- linkage, along with those occurring in the 1400 cm^{-1} region for the cadmium halide complexes and the oxalate salt.

The electric moment of tetramethyl-2-tetrazene was found to have a value of 1.2 ± 0.1 D. by two different methods. This value, however, does not permit the assignment of either a cis-or a trans-structure to the hydronitrogen.

PART II

The chlorine atoms on the trimeric phosphonitrilic ring have been shown to be less reactive than previous workers have indicated. The reactivity of the chlorine atoms decreases progressively as the number of non-halogen substituents on the ring is increased. The ease and the degree of solvolysis of the halides has been related to the base strength of the solvolytic agent and to its effective concentration.

The preparation of a tri-substituted derivative, tri-(phosphonitrile) trichloro-tris-diethylamide, has shown that pairwise replacement of the chlorine atoms is not necessarily always indicated.

The action of sodium in liquid ammonia on trimeric phosphonitrilic chloride results in the cleavage of the phosphonitrilic ring as evidenced by the reaction mole ratio of 8:1 of sodium to triphosphonitrilic chloride and the formation of phosphine as a reduction product.

The characteristic infrared absorption spectra of several N-substituted phosphonitrilic derivatives were obtained and all were found to possess an absorption band in the region of 1200 cm^{-1}. Since this frequency had previously been assigned to the phosphorus-nitrogen ring vibrations, retention of the ring structure in these derivatives is verified. 127 pages. $2.00. Mic 58-4057

I. THE ROLE OF WATER IN ETHYLENIMINE RING OPENINGS; II. ULTRAVIOLET SPECTRA, IONIZATION CONSTANTS, PEROXIDES AND POLYMERS OF TELLURIC ACID.

(Publication No. 23,433)

Joseph Emmett Earley, Ph.D.
Brown University, 1957

I

The mechanism of ethylenimine hydrolyses has been investigated by kinetic methods. A method has been devised for the analysis of ethylenimines in strongly acidic media. Rate constants have been measured at several temperatures for hydrolyses of 2,2-dimethylethylenimine,

2-ethylethylenimine, ethylenimine and N-(n-butyl)-ethylenimine. Activation thermodynamic quantities have been computed for the former three imines. Volumes of activation ($\triangle V^*$) at 8,000 p.s.i. and 21° C. have been measured for the same three imines.

Second order rate constants have been measured for nineteen reactions of the four imines with various nucleophiles including the acetate, bromide, chloride, iodide, thiocyanate and thiosulfate ions.

A potentiometric method was devised whereby the composition of the hydrolysate of 2,2-dimethylethylenimine was determined. Values of the basic dissociation constants of four aminoalcohols were determined in connection with this analysis.

The second order rate constants for reactions of imines and active nucleophiles were satisfactorily correlated by the use of two and three parameter equations. By the use of these correlations, rate constants for the bimolecular attack of a water molecule on three imines were estimated. These constants were compared with the measured hydrolysis rate constants. This comparison indicated a sizeable unimolecular contribution in the case of 2,2-dimethylethylenimine. A small contribution due to polymization and/or unimolecular ring opening was indicated for the hydrolysis of 2-ethylethylenimine. The values of the activation thermodynamic quantities and product analyses for these hydrolyses confirm this indication.

Comparison of the second order hydrolysis constants computed from the observed pseudo first order constants, taking into account the contributions mentioned above, with the corresponding constants computed from the measured second order constants for the faster reactions led to the conclusion that the nucleophilic activity of water is slightly less than has been previously supposed.

II

A study of the variation of the optical density of aqueous telluric acid solutions with hydrogen ion activity was made; evidence was found for three consecutive ionizations. The thermodynamic value for the equilibrium constant for the first ionization was determined by potentiometric measurements of the pH of exactly half-neutralized solutions of telluric acid. The pH of such solutions was found to depend on both the ionic strength and the concentration of the telluric acid-tellurate buffer. The thermodynamic value of the first ionization constant was found to be $K_1 = 2.0 \times 10^{-8}$.

Measurements of the pH of solutions of monopotassium tellurate were used to determine the thermodynamic value 9.1×10^{-12}, for the second ionization constant. Spectrophotometric data indicated that the value of the third ionization constant is about 3×10^{-15}.

Extinction coefficients were measured in the ultraviolet region for telluric acid and for the mono- and di-negative tellurate ions. These coefficients and the measured ionization constants were shown to be consistent with the pH vs optical density measurements.

The agreement of the observed ionization constants with semi-empirical predictions and also the spectral data were interpreted to show that no dehydration of any of the tellurate species occurs.

Potentiometric measurements on solutions of the pure acid indicated that polymers, principally trimers, are formed in aqueous solution. The formation of peroxytellurates was shown to take place to a small extent. The stability constant of the monoperoxytellurate ion was found to have the value $K_c = 0.68$.

110 pages. $2.00. Mic 58-4058

THE STEREOCHEMISTRY OF SOME COBALT (III) COMPLEXES CONTAINING OPTICALLY ACTIVE LIGANDS

(Publication No. 25,217)

Bennie Anthony Ferrone, Ph.D.
University of Illinois, 1957

The initial objective of this work was a study of the cobalt (III) complexes of optically active 1,2-diphenylethylenediamine with a view toward using them in studies on preferential coordination. The most convenient starting material for this study was trans-$[Co(d\text{-stien})_2\ Cl_2]Cl$ (stien = 1,2-diphenylethylenediamine). Resolutions of tartaric acid, propylenediamine, and trans-1,2-diaminocyclohexane were attempted. No resolutions were obtained.

When trans-$[Co(d\text{-stien})_2\ Cl_2]Cl$ was allowed to react with racemic-1,2-diphenylethylenediamine, resolution of the base seemed to occur; however, on the basis of previous experience, the "wrong" isomer appeared to coordinate preferentially. Investigation of this reaction led to the conclusion that diastereoisomeric species were being produced. A more complete examination required a study of the products of the following reactions:

I. trans-$[Co(d\text{-stien})_2\ Cl_2]Cl$ + 2 d,l-stien =

II. trans-$[Co(d\text{-stien})_2\ Cl_2]Cl$ + l-stien =

III. trans-$[Co(d\text{-stien})_2\ Cl_2]Cl$ + 2 l-stien =

IV. trans-$[Co(d\text{-stien})_2\ Cl_2]Cl$ + 2 meso-stien =

Fractionation of the products of these reactions gave two distinctly different fractions in each case. With the exception of reaction III, Fraction I, or the easily crystallizable fraction, had a positive rotation at the D line of sodium, whereas Fraction II had a negative rotation. In the case of reaction III all products were inactive.

Optical rotatory dispersion curves of all the fractions gave indications that a number of isomers had been isolated. Therefore, each fraction was decomposed, the 1,2-diphenylethylenediamine was recovered, and its optical rotation was determined. This gave evidence for the existence of the isomers D-$[Co(d\text{-stien})_2(l\text{-stien})]Cl_3$, L-$[Co(d\text{-stien})_2(l\text{-stien})]Cl_3$, D-$[Co(d\text{-stien})_2(meso\text{-stien})]Cl_3$, and L-$[Co(d\text{-stien})_2(meso\text{-stien})]Cl_3$. In addition, the isomers D-$[Co(d\text{-stien})_3]Cl_3$ and L-$[Co(d\text{-stien})_3]Cl_3$ were isolated from the reaction

trans-$[Co(d\text{-stien})_2\ Cl_2]Cl$ + d-stien =

It was found that heating an alcoholic solution of D-$[Co(d\text{-stien})_3]Cl_3$ under reflux for several hours caused a change in rotation from a high positive value to a negative value. This is indicative of the fact that although a number of isomers are isolable from this system, they are not of equal stability.

Altogether, evidence was found for twelve of the

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eighteen isomers possible in the cobalt (III)-1,2-diphenylethylenediamine system.

A study was also undertaken on the cobalt (III) complex of trans-1,2-diaminocyclohexanetetraacetic acid (H_4DCTA). It is hoped that this ligand could be resolved and its active cobalt (III) complex used in the manner of Kirschner's work with the cobalt (III)-ethylenediaminetetraacetate complex (1).

Some difficulty was encountered in preparing the $[Co\ DCTA]^-$ ion, but a convenient synthesis was eventually found. Resolution of this ion was attempted with a number of reagents, but with no success. Resolution of the base was then attempted, but to no avail. A synthesis of the active base from optically active trans-1,2-diaminocyclohexane also failed. Finally, an attempt was made to resolve the $[Co\ DCTA]^-$ ion by the reaction

$$2\ \underline{D,L}\text{-}[Co\ DCTA]^- + 3\ \underline{l}\text{-pn} = \underline{D}\text{-}[Co(\underline{d}\text{-DCTA}]^- + [Co(\underline{l}\text{-pn})_3]^{3+} + \underline{l}\text{-DCTA}^{4-}$$

However, this method failed also because of the reduction of the $[Co\ DCTA]^-$ species.

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OBSERVATIONS ON THE RARE EARTHS: CHELATES DERIVED FROM DIAMINE TETRA- AND TRI-ACETIC ACIDS

(Publication No. 25,230)

Earl Philip Horwitz, Ph.D.
University of Illinois, 1957

The objects of this present work were to characterize more completely the complexes that can be formed between ethylenediaminetetraacetic acid, abbreviated H_4(EDTA), N-hydroxyethylethylenediaminetriacetic acid, abbreviated H_3(HEDTA), and 1,2-diaminocyclohexanetetraacetic acid, abbreviated H_4(DCTA), and the rare earth metal ions, and to study the nature of the bonding and structures of the complexes thus formed.

Neutralization curves were determined for H_3(HEDTA) and H_4(DCTA) in and without the presence of rare earth metal ions. These curves have shown that stable complexes with a 1:1 ratio of rare earth metal ion to HEDTA or DCTA were formed. Approximate values for the formation constants of these complexes were calculated from data obtained from the titration curves. The formation constants of the rare earth-HEDTA, -EDTA, and -DCTA complexes were correlated with the charge squared divided by the radius of the rare earth metal ions. It was shown that the size and charge of the rare earth metal ion are not the only factors influencing the stability of these rare earth chelates.

Complexes of the type Ln(HEDTA) have been prepared for neodymium, samarium, europium, gadolinium, and yttrium by treating rare earth carbonate with H_3(HEDTA) in a 1:1 rare earth metal ion /HEDTA ratio and precipitating the complex from aqueous solution with isopropyl alcohol. X-ray diffraction studies have shown that the chelate compounds are isomorphous.

Complexes of the type $Ba[Ln(DCTA)]_2$ have been prepared for neodymium, samarium, europium, gadolinium, and yttrium by treating rare earth carbonate first with H_4(DCTA) and then with barium carbonate. The chelate compounds were precipitated from aqueous solution with 95% ethanol. X-ray diffraction studies have shown that the chelate compounds are isomorphous.

Magnetic susceptibilities of a number of rare earth-HEDTA, -EDTA, and -DCTA chelates were measured at room temperature. The generally fair agreement between the magnetic moments of the chelate compounds and the hydrated sulfates indicates that the 4f electrons are not of great significance in the bonding in rare earth chelates of the type studied.

The absorption spectra of aqueous solutions of the chlorides of praseodymium, neodymium, samarium, and europium were measured in the presence of HEDTA and DCTA. It was noted that there is no correlation between alteration in the absorption spectra of the tripositive rare earth metal ions when complexed with HEDTA, EDTA, and DCTA and the stability of the chelates formed.

Differential thermal analysis has indicated the thermal stabilities of the rare earth-HEDTA and -DCTA chelates with respect to dehydration and decomposition. Dehydration studies of $NH_4[Sm(EDTA)]\cdot 8H_2O$ and $Sm(HEDTA)\cdot 5H_2O$ have shown that one water molecule per chelate molecule is more tenaciously held by the chelate than the rest of the water molecules. This suggests that the water molecule is occupying the sixth coordination position in the coordination sphere.

Infrared absorption spectra of Ln(HEDTA) and $Ba[Ln(DCTA)]_2$ type chelates were obtained. The spectra indicate that all three carboxyl groups in Ln(HEDTA) chelates are complexed. The spectra also indicate the high degree of ionic character in the rare earth- carboxyl linkage.

The lengths of the edges of the unit cell and the number of molecules per unit cell were measured for the orthohombic-hemimorphic crystals of $Na[Nd(EDTA)]\cdot 8H_2O$. The lengths of the edges of the unit cell were found to be the following: a = 9.87 Å., b = 17.7 Å., and c = 6.22 Å. The crystal was found to contain two molecules per unit cell. 114 pages. $2.00. Mic 58-4060

A STUDY OF THE SYSTEM SODIUM-AMMONIA-DIBORANE

(Publication No. 25,126)

Rev. Francis Joseph Koenig, S.J., Ph.D.
St. Louis University, 1957

To gain further insight into the reaction of boron hydrides with electrons and with electron-pair donors, it was proposed to study a competitive system whereby both an electron donor and an electron-pair donor were reacted simultaneously with an electron deficient borane. Representative of such a system is sodium-ammonia-diborane. The sodium acts as the electron donor, the ammonia partakes of the dual role of solvent and electron-pair donor, while the diborane represents the simplest stable electron-deficient boron hydride. It would be anticipated that reaction with electrons and electron-pair donors would be characteristic of the electron-deficient bridge systems of

the boranes and that the behavior of these systems toward such reactants should give considerable insight into the chemistry unique to the boron hydrides and their structural units.

Gaseous diborane was added to the liquid eutectic sodium-ammonia mixture in equilibrium with solid ammonia and to the liquid eutectic sodium-ammonia mixture in equilibrium with solid sodium at -110°. In both cases the addition was accomplished without the evolution of hydrogen which suggests that a reaction different than that postulated for the reaction of sodium with the diammoniate of diborane according to the equation:

$$Na + B_2H_6 \cdot 2NH_3 = 1/2\ H_2 + NaBH_4 + NH_2BH_2 + NH_3$$

has occurred or that a stable intermediate has been formed.

The stepwise formation of one-third mole ratio of hydrogen, the X-ray diffraction patterns identifying one of the products as sodium hydroborate, the separation of the reaction products by ethylene glycol dimethyl ether into two portions each containing equal amounts of boron, the analyses for nitrogen which showed that either two-thirds or one mole ratio of nitrogen was retained by the reaction products, have suggested that diborane reacts with the sodium-ammonia eutectic mixture to form sodium hydroborate and $NaB_3H_8(NH_3)_2$ according to the equation:

$$4Na + 3B_2H_6 + 2NH_3 = NaB_3H_8 \cdot 2NH_3 + 3NaBH_4.$$

The subsequent fate of the compound $NaB_3H_8 \cdot 2NH_3$ depends first of all upon the reaction medium in which the diborane was reacted with the sodium-ammonia eutectic. If the diborane is added to the eutectic sodium-ammonia in equilibrium with solid ammonia, one sequence of reactions occurs as is evidenced by the stepwise hydrogen production, whereas, if the diborane is added to the sodium-ammonia eutectic in equilibrium with solid sodium, a second sequence of reactions different from the first and evidenced by a different stepwise hydrogen production occurs.

It is essential to note, however, that in both sequences if the solvent ammonia is removed at the lowest possible temperatures, a one-third mole ratio of hydrogen to diborane is formed. The formation of this two-thirds of an equivalent of hydrogen, coupled with the fact that one-half of the boron compound is soluble in ethylene glycol dimethyl ether while the other one-half is insoluble, can only be explained by postulating that the diborane molecule cleaves unsymmetrically under the aforementioned experimental conditions. 101 pages. $2.00. Mic 58-4061

MECHANISMS OF REACTIONS OF PLATINUM COORDINATION COMPOUNDS

(Publication No. 24,914)

Aubrey Francis Messing, Ph.D.
Northwestern University, 1957

The platinum complex levo-meso-stilbenediamine-iso-butylenediamine-platinum(II), Pt(i-bn)(m-stien)$^{2+}$, was oxidized with one and two electron reagents to levo-trans-dichloro-meso-stilbenediamine-iso-butylenediamine-platinum(IV), Pt(i-bn)(m-stien)Cl_2^{2+}. This in turn was reduced to the original platinum(II) complex with one and two electron reducing agents. In none of these four different combinations of reactions was there any evidence of racemization. These results demonstrate the stability of the platinum-ethylenediamine chelate rings in oxidation-reduction reactions. Further, it is concluded that the platinum-nitrogen bonds retain a fixed square configuration during these reactions.

Substitution reactions in complex compounds of platinum(IV) were found to proceed at a rate dependent upon the concentration of the substituting agent. The reactions studied were originally thought to be examples of an S_N2, direct displacement, mechanism. Further investigation revealed that the presence of trace amounts of platinum(II) has a catalytic influence on the rate of substitution whereas the addition of cerium(IV) virtually stops the reaction.

These data have been interpreted as an oxidation-reduction process which sets up a chain mechanism. This involves a labile platinum(III) intermediate, generated by the interaction of platinum(IV) with trace amounts of platinum(II) impurities.

$$Pt(IV) + Pt(II) \underset{k_2}{\overset{k_1}{\rightleftharpoons}} 2\ Pt(III)$$

The chain reaction in turn takes place by the interchange

$$^{*}Pt(IV) + Pt(III) \rightleftharpoons {}^{*}Pt(III) + Pt(IV$$

Substitution then occurs through the labile platinum(III) intermediate,

$$Pt(III) + {}^{*}Y \xrightarrow{k_3} Pt(III) + Y$$

where Y is the ligand replaced by $^{*}Y$.

The equation

$$k_{obs} = k_3\left[\frac{k_1}{k_2}\right]^{1/2}\left[\frac{Pt(II)}{Pt(IV)}\right]^{1/2} Y$$

derived for the above mechanism is found to agree with the observed results. 95 pages. $2.00. Mic 58-4062

A STUDY OF THE ADSORPTION OF SURFACE ACTIVE MATERIALS BY DIFFERENTIAL CAPACITY MEASUREMENTS

(Publication No. 25,257)

Benjamin Mosier, Ph.D.
University of Illinois, 1957

The study of the adsorption of surface active materials has been made much more exact in recent years through the investigation of the differential electrical capacity of metal solution interfaces using alternating current bridge techniques.

This investigation was undertaken with the intent of studying the adsorption of a number of surface active materials at a mercury solution interface. The region of adsorption – desorption is established by studying the differential capacity as a function of the polarizing potential. The differential capacity is studied as a function of concentration in the region of adsorption and an adsorption isotherm is constructed. The limiting value of capacity

which should theoretically correspond to a saturated monolayer is deduced from an empirical relationship having the form of a Langmuir adsorption isotherm. The fraction of the surface covered by adsorbate is calculated for each concentration taken and interpreted in terms of a single constant Langmuir adsorption isotherm. This constant is defined as an adsorption index and from its order of magnitude a relative surface active character is reflected. It is shown that within a given benzpyridine series such as pyridine, quinoline, and acridine, that with the addition of each benzene group to the pyridine heterocycle, the greater the surface active character. It is observed that the limiting value of differential capacity decreases in this series, and this decrease is ascribed to a corresponding decrease in the polarity of the adsorbed layer. Steric influences, such as are evident in the structural model of triethylamine, have been shown to have little if any, effect in impeding the adsorption at the electrode surface. Triethylamine completes a saturated monolayer at a lower concentration than quinuclidine. The greater surface active character for triethylamine is ascribed to its flatter orientation at the electrode surface. Steric influences have been shown to be operative in hindering the adsorption of diisopropyl ketone, which completes a saturated monolayer at a somewhat higher concentration than di-n-propyl ketone. For compounds which are either reversibly or irreversibly reduced at the dropping mercury electrode, a comparison is made of the adsorption characteristics of the oxidized and reduced forms. The respective roles of the adsorbates in the polarographic reduction process are illustrated for several compounds. From the appearance of a "pseudocapacity" in the region of the reduction potential as is observed in the polarographic reduction potential of phenazine, methylene blue and Alizarin Red S, a qualitative interpretation is given regarding the reversibility of the electrochemical reaction. Various phenomena, such as pre-waves and post-waves are given a plausible explanation based upon differential capacity measurements. Differential capacities of the electrical double layer between mercury and aqueous solutions of tetraalkylammonium halides have been made to show the role of adsorption of the cation upon strong cathodic polarization. A discriminate evaluation of the capacitance-polarization data is made from a study of the fraction of the surface covered as a function of polarizing potential. Co-solvents are discussed and their applicability to differential capacity measurements is emphasized.

154 pages. $2.05. Mic 58-4063

LOWER OXIDATION STATES OF SAMARIUM

(Publication No. 25,170)

Marvin Luis Muga, Ph.D.
The University of Texas, 1957

Supervisor: Professor George W. Watt

Previous studies concerning the interaction of potassium and salts of the lanthanide elements in liquid ammonia have been greatly hampered because of the limited solubility of the lanthanide compounds. Experiments were initiated to prepare an ammonia-soluble lanthanide salt and to investigate its reaction with potassium in liquid ammonia.

The synthesis of samarium(III) iodide by the interaction of acetyl iodide and samarium(III) acetate in an inert solvent was found to be impractical. The formation of samarium(III) trifluoroacetate and its diammoniate was accomplished and the compounds were found to be appreciably soluble in liquid ammonia and stable toward ammonolysis.

Studies of the reaction occurring upon the addition of one, two and three equivalents of potassium to an ammonia solution of samarium(III) trifluoroacetate indicate the formation of a transient bivalent samarium species followed by reduction of the trifluoroacetate ion.

A mechanism, which is consistent with all experimental observations is presented for the reduction by one and two equivalents of potassium.

The reduction with three equivalents of potassium resulted in an ammonia-soluble compound, identified as potassium trifluoroacetate, and an ammonia-insoluble product for which is proposed an empirical formula that agrees very well with the experimental data. On the basis of material balance data, it is necessary to assume the formation of one or more volatile products.

Although the reduction with potassium in liquid ammonia provides a unique means of obtaining a lower oxidation state of samarium, the susceptibility of the carboxyl group to reduction by samarium(II) obviates success in isolating a lower valent species.

70 pages. $2.00. Mic 58-4064

STUDIES OF THE CHEMISTRY OF SYSTEMS INVOLVING WATER, HYDROGEN PEROXIDE AND PLUTONIUM(IV) NITRATE IN TRI-n-BUTYL PHOSPHATE

(Publication No. 24,941)

Lawrence J. Mullins, Jr., Ph.D.
The University of New Mexico, 1957

The reaction of tri-n-butyl phosphate, (TBP), with water and hydrogen peroxide is studied by means of distribution experiments. The solubility of water in TBP-hexane, at low TBP concentrations, is consistent with the premise that $H_2O \cdot TBP$ is the principal solvate species in the organic phase. The distribution of hydrogen peroxide from aqueous solution into TBP-hexane indicates that $H_2O_2 \cdot 2TBP$ is the solvate species formed at low hydrogen peroxide concentrations. The distribution data at high hydrogen peroxide concentrations indicate that another species such as $H_2O_2 \cdot TBP$ is also present.

The reaction of hydrogen peroxide with plutonium(IV) nitrate in TBP is studied by a spectrophotometric method. A complex is formed which contains one plutonium atom and two peroxy-oxygen atoms. The formation of the complex can be represented by the following equation:

$$Pu(NO_3)_4 \cdot 2TBP + H_2O_2 \cdot 2TBP \rightleftharpoons Pu(OO)(NO_3)_2 \cdot 2TBP + 2(HNO_3 \cdot TBP)$$

If the concentrations are expressed in moles per liter, the equilibrium constant for this reaction at 25°C is 49.7 (±0.5) at a nitric acid concentration of 0.235 M.

The precipitation of plutonium peroxide from

TBP-hexane solution is demonstrated. The effect of water, nitric acid, and hydrogen peroxide concentrations on the solubility and crystal structure of plutonium peroxide precipitated from TBP solution is investigated. Both the solubility and crystal structure of the precipitate strongly depend on the water and nitric acid concentrations. The face-centered cubic structure of plutonium peroxide is favored by high water and low nitric acid concentrations. The hexagonal platelet structure of plutonium peroxide is favored by low water and high nitric acid concentrations. The data are consistent with the premise that the face-centered cubic structure is a polymeric structure in which $(PuOPu)^{+6}$ groups are linked by peroxy-oxygen atoms.

121 pages. $2.00. Mic 58-4065

PHYSICAL CHEMICAL STUDIES OF SOME COMPLEX INORGANIC COMPOUNDS: I. THE KINETICS OF AQUATION OF cis-DICHLORO-bis-(ETHYLENEDIAMINE)-CHROMIUM (III) ION. II. THE STEREOCHEMISTRY OF SOME TRIETHYLENETETRAMINE COMPLEXES. III. THE REDUCTION OF A NITRO GROUP COORDINATED TO PLATINUM.

(Publication No. 25,279)

Joel Selbin, Ph.D.
University of Illinois, 1957

Part I reports a study of the kinetics of acid hydrolysis of cis-$[Cren_2Cl_2]^+$ at pH = 1.0, under various conditions of added electrolytes and at three temperatures. A chloride concentration cell was employed to measure chloride release. The pseudo first order rate constant for the loss of one chloride is given by $k_1 = 9.65 \times 10^{11}$ exp. (-21,100/RT) $sec.^{-1}$, and $\Delta S^* = -5.7$ e.u. A value for the specific rate constant for the loss of a second chloride has been estimated. The effects of certain salt additions have been interpreted as support for an S_{N1} mechanism. A change in the specific rate constant with initial concentration of complex has been observed and the overall rate found to be proportional to the initial concentration. A possible explanation for this behavior is presented. Results of studies on the change in optical rotation of l-cis-$[Cren_2Cl_2]^+$ are interpreted in terms of an initial aquation without loss of optical activity followed by racemization of the chloroaquo product. The chloroaquo product racemizes at a greater rate than it aquates, indicating that different mechanisms must be operative for the two processes. Analogies with the corresponding cobalt(III) complexes suggest that complexes of the two metals follow similar mechanisms during acid hydrolysis. A suggestion is made as to why chromium(III) complexes resemble cobalt(III) complexes so closely.

Part II presents the results of a study of some triethylenetetramine (trien) complexes of cobalt(III), in which a search was made for a complex having the four amine nitrogens disposed equatorially about the metal ion. Visible and ultraviolet spectra indicated that only one of the three possible stereochemical modifications of the ion [Co trien$(NO_2)_2$]$^+$ was formed, although six different methods were used for its preparation. The data are interpreted as support for a cis structure. However, nine resolving agents were employed in unsuccessful attempts to resolve the ion and thus unequivocal evidence for the cis arrangement was not obtained. Two methods of preparation of the ion $[Co\ trienBr_2]^+$ yielded a green product and one method produced a deep gray violet product, both giving the same analysis. By analogy to numerous cis-trans pairs of diacidotetrammine type complexes of cobalt(III) and chromium(III) the green compound is assigned a trans configuration. The planar disposition of the four trien nitrogens is thus established in the dibromo complex. In the course of this study the first well-established example of a crystalline complex of cobalt(III) containing the quinquidentate coordinating agent, tetraethylenepentamine (tetren) was prepared.

Part III concerns a semi-quantitative polarographic investigation of some cobalt(III) and platinum(II) complexes, each containing a coordinated nitro group. The supporting electrolyte was either tenth molar perchloric acid or tenth molar sodium perchlorate. The purpose of the study was to find evidence for the possibility of reducing a nitro group coordinated to a metal ion, without reducing the metal itself. No success was obtained with a series of cobalt(III) complexes, the reduction of cobalt(III) to cobalt(II) always occurring with subsequent decomposition of the complex. However, several interesting observations were made concerning the stability toward reduction of certain cobalt complexes. Two new platinum(II) complexes were prepared, each containing one nitro group and a tridentate chelating agent. These are [Pt dien(NO_2)]Br and [Pt bamp(NO_2)]NO_3 (where dien = diethylenetriamine, bamp = 2,6-bis-(aminomethyl)-pyridine). Both of these compounds were found to give a polarographic wave in tenth molar perchloric acid which is four electrons high. The half-wave potential was about -0.6 volts versus the saturated calomel electrode. This is interpreted as a reduction of the coordinated nitro group to a hydroxylamine group. Suggestions are made concerning further confirmatory experiments.

158 pages. $2.10. Mic 58-4066

CHEMISTRY, ORGANIC

THE PERCHLORIC ACID-CATALYZED DEHYDRATION OF TETRAPHENYLETHANOL IN ACETIC ACID SOLUTION

(Publication No. 25,109)

Sister Mary LaVonne Abts, F. S. P. A., Ph.D.
St. Louis University, 1957

The kinetics of the perchloric acid-catalyzed dehydration in acetic acid solution of 1,1,2,2-tetraphenylethanol and of its dimethoxy-substituted derivatives, 1,1-bis(p-methoxyphenyl)-2,2-diphenylanol and 1,1-diphenyl-2,2-bis(p-methoxyphenyl)-ethanol, were investigated.

The results of the investigation support the proposed unimolecular (E_1) elimination mechanism in which the dehydration proceeds by way of the oxonium ion of the carbinols to the carbonium ion. Furthermore, it was shown that, unlike the reactions of 1,1,2-triphenylethanol

previously studied in this laboratory, the dehydration of the carbinols in the tetraphenyl series is a kinetically simple first order reaction, which shows no evidence of acetate ester formation and participation. The electron withdrawing inductive effect of the phenyl groups attached to the carbon from which the proton is lost to form the olefin, as well as steric factors which prevent solvent molecules from making a successful attack on the carbonium ion, may be responsible for this difference in behavior.

The thermodynamics of activation indicate that the retarding influence of the fourth phenyl group on the rate of dehydration can largely be ascribed to an entropy effect, possibly of steric origin, rather than to a decrease in the basic properties of the carbinol. The marked change in the rate of the dehydration produced by the methoxy groups when substituted in different positions in the molecule is consistent with theoretical predictions made in the light of the electronic theory and the proposed unimolecular mechanism.

For the three reactions studied it was shown that as the water content of the acetic acid solvent is increased the specific rate of olefin formation is decreased and that the changes in rate correlate very closely with changes in the acidity of the medium as measured by the Hammett acidity function. This correlation implies the existence of a linear relationship between the free energy of activation and the acidity function, H_o. Data obtained showed that the entropy of activation for the dehydration of tetraphenylethanol increases as the water content of the medium increases and that there are compensating increases in the energy of activation of such magnitude that the net result is an increase in the free energy term and a corresponding decrease in rate of reaction. The increase in energy and entropy of activation which accompany the increase in water content of the solvent is interpreted as a solvation effect, the transition state complex being assumed to be less susceptible to solvation than are the reactants.

128 pages. $2.00. Mic 58-4067

AN APPROACH TO THE SYNTHESIS OF A-NOR STEROIDS IN THE PREGNANE SERIES

(Publication No. 23,419)

Harry Agahigian, Ph.D.
Brown University, 1957

The preparation of A-nor steroids of the pregnane series employing the aldol condensation as the method of ring contraction was studied. The various synthetic sequences attempted and the relative merits of each are discussed.

The synthesis involved the conversion of either pregnenolone or progesterone to allopregnane-3,20-dione. The catalytic reduction of pregnenolone and subsequent oxidation of allopregnane-3β-ol-20-one to allopregnane-3,20-dione was accomplished in 70% over-all yield. The bromination of this compound and dehydrohalogenation of the resulting 2α-bromoallopregnane-3,20-dione yielded the desired Δ^1-allopregnene-3,20-dione. Due to the nearly equal reactivity of the two keto groups in this molecule a more desirable intermediate for further synthesis was found.

The carbonate ester of allopregnane-3β-ol-20-one was prepared and pyrolyzed at 300°C under reduced pressure to yield Δ^2-allopregnene-20-one and Δ^3-allopregnene-20-one. The olefin mixture was converted to the glycols by means of the Prévost reaction. The quantitative reduction of the diacetates to the glycol with lithium aluminum hydride provided an excellent method for studying the reaction conditions of the periodic acid cleavage of the glycols and aldol condensation of the dialdehydes.

The conversion of the condensed aldehydes to the A-nor ketones was attempted in a variety of ways. The catalytic reduction of the α,β-unsaturated aldehydes to the saturated aldehydes was satisfactory but oxidation of the prepared "enamines" or "enol acetates" to the A-nor ketone was unsuccessful.

The condensed aldehydes were converted to the epoxy-aldehydes and then reduced with lithium aluminum hydride to the glycol. The cleavage of this glycol was accomplished with periodic acid and the A-nor ketones were prepared but the yields were poor. In addition the saturated aldehydes were treated with perbenzoic acid to form the formate ester. The formate esters were hydrolyzed and the resulting alcohols oxidized to the A-nor ketones. The reactions of this sequence and others where there was the possibility of the presence of more than one isomer were followed by infrared analysis. The chromatographic separations on the isomer mixtures that were prepared are also discussed. 76 pages. $2.00. Mic 58-4068

HYDROLYSIS OF ALKYL HYDROGEN ARYLPHOSPHONATES

(Publication No. 24,861)

Beatrice Arnowich, Ph.D.
New York University, 1957

Adviser: Professor Robert T. Morrison

We have studied four aspects of the acidic hydrolysis of alkyl hydrogen arylphosphonates:

(a) the kinetics, to determine what species undergo hydrolysis;

(b) the relationship between structure and reactivity, to determine the effects of electronic and steric factors;

(c) the stereochemistry, to determine the point of cleavage and the possible participation of carbonium ions; and

(d) the behavior in highly acidic solutions, to determine whether water participates in the rate-determining step.

The results indicate that all esters studied undergo uncatalyzed hydrolysis of the unionized form, and that some of the esters also undergo acid-catalyzed hydrolysis of the unionized form.

Toward catalyzed hydrolysis, the esters follow the reactivity sequences benzyl $>$ sec-butyl $>$ isopropyl $>$ ethyl, and benzyl $\gg$ p-nitrobenzyl. Toward uncatalyzed hydrolysis, the reactivity sequences are benzyl $>$ ethyl $>$ isopropyl $>$ sec-butyl, and benzyl $>$ p-nitrobenzyl, with smaller differences in rate than for catalyzed hydrolysis.

sec-Butyl hydrogen p-nitrophenylphosphonate undergoes catalyzed hydrolysis with inversion of configuration

and considerable racemization; it undergoes uncatalyzed hydrolysis with almost complete racemization.

Hydrolysis of the sec-butyl and isopropyl esters at high acidities is proportional to the Hammett acidity function, H_o; hydrolysis of the ethyl and p-nitrobenzyl esters at high acidities is independent of the activity of water. Both these findings indicate the non-participation of water in the rate-determining step.

We propose that catalyzed hydrolysis proceeds by unimolecular heterolysis of the protonated ester to form the carbonium ion, which is the rapidly hydrated. We propose tentatively that uncatalyzed hydrolysis proceeds by intramolecular transfer of the acidic hydrogen to alkyl oxygen with the simultaneous separation of a carbonium ion.

108 pages. $2.00. Mic 58-4069

PYROLYSES OF DIHYDROPYRAN DERIVATIVES

(Publication No. 24,087)

Myron Becker, Ph.D.
The Ohio State University, 1952

A reaction characteristic of many vinyl ethers is the rearrangement to the aldehyde which occurs upon heating. Such a rearrangement has been observed by Wilson[1] in the pyrolysis of 2,3-dihydrofuran to cyclopropanecarboxaldehyde and crotonaldehyde at 460°. Cyclopropanecarboxaldehyde was found to give a small amount of dihydrofuran at 500°; thus the decomposition was reversible.

A similar sequence of reactions was reported by Aten[2] in the thermal decomposition of methyldihydrofuran to cyclopropyl methyl ketone and propenyl methyl ketone. The first step, a vinyl ether rearrangement, was not measurably reversible.

Several pyrolyses of 3,4-dihydro-2H-pyran derivatives have also been studied.[3,4] Bremner, Jones, and Beaumont[3] have found that 3,4-dihydro-2H-pyran decomposed at 500-540° to acrolein and ethylene. This decomposition did not seem to occur by a chain mechanism involving free radicals. Acrolein and ethylene have also been obtained from tetrahydrofurfuryl alcohol in one stage by use of an aluminum silicate catalyst.[5] By analogy to the pyrolysis of 2,3-dihydrofuran, Wilson[5] has suggested the possible existence of a cyclobutanecarboxaldehyde intermediate in such a sequence of reactions.

The purpose of this research was to study the pyrolyses of various 3,4-dihydro-2H-pyran derivatives and to determine whether they rearranged to cyclobutyl intermediates during their degradations. Absence of such intermediates would denote that the decompositions probably occurred by a reverse Diels-Alder type mechanism, as exemplified by the reversion of cyclohexene to ethylene and 1,3-butadiene.[6]

The problem was approached from two directions. First, dihydropyran and the postulated intermediate, cyclobutanecarboxaldehyde, were decomposed under similar conditions. A comparison of the results should indicate qualitatively whether the cyclic aldehyde conformed with the requisites of a chemical intermediate. Secondly, several 3,4-dihydro-2H-pyran derivatives substituted in the two position were pyrolyzed and the products were carefully isolated. The intervention of an unsymmetrical cyclobutyl intermediate in the reaction might be manifested by the presence of four products rather than by the usual two formed in the decomposition of a Diels-Alder adduct. This would result from a dual division of the saturated cyclobutane ring. The occurrence of such fissions in saturated four-membered rings has been noted by several investigators.[7,8]

Cyclobutanecarboxaldehyde was prepared by the pyrolysis of the calcium salts of cyclobutanecarboxylic and formic acids.[9] Three new procedures, involving the reduction of cyclobutanecarbonitrile with lithium aluminum hydride, the reduction of cyclobutanecarboxylic acid chloride with sodium trimethoxy borohydride, and the dehydrogenation of cyclobutanemethanol over a silver-copper on pumice catalyst, were also used. The yields obtained by these methods were respectively 12, 23, 8-26, and 39%.

Samples of 3,4-dihydro-2H-pyran (42 g. each, 0.5 mol./hour) were passed through a pyrex pyrolysis tube packed with glass helices and chips at 350°, 400°, and 450°. Nitrogen at the rate of 2.5 liters/hour was used as a carrier gas. The liquid product was condensed in dry ice traps, gas samples were taken for analysis, and the residual gas was passed through a bromine-carbon tetrachloride solution to remove any unsaturated hydrocarbons. Products obtained were acrolein, unreacted dihydropyran, ethylene (as the dibromide), and the gases carbon dioxide, carbon monoxide, ethylene, and hydrogen.

Cyclobutanecarboxaldehyde (12 g. samples) was thermally decomposed under similar conditions at 350°, 400°, and 450° to the same products, acrolein and ethylene. The results for the gas analyses, the percentage of aldehyde that reacted, and the percentage of conversion of products were roughly comparable to those obtained for dihydropyran. Thus it was shown that the aldehyde was stable enough to be isolated if it was ever formed freely in the thermal decomposition of dihydropyran. However, attempts to isolate this aldehyde from the pyrolysis products of dihydropyran by distillation, by the formation of its sodium bisulfite adduct, or by pyrolyzing the dihydropyran with toluene to suppress interference from chain reactions proved unsuccessful. Also, no conversion of the cyclobutanecarboxaldehyde to dihydropyran was ever noted.

The pyrolysis of 3,4-dihydro-2H-pyran-2-carboxaldehyde (0.5 mol./hour) at 400° with nitrogen (2.5 liters/hour) as a carrier gas produced acrolein (88%) and only traces of ethylene. If a cyclobutane intermediate had intervened in the decomposition, a considerable quantity of ethylene should have been obtained.

Under similar conditions the pyrolysis of 2-phenyl-3,4-dihydro-2H-pyran yielded acrolein (78.5%) and styrene (80.4%), but no cinnamaldehyde and a negligible quantity of ethylene. Cinnamaldehyde was shown to be stable under the conditions of this latter pyrolysis.

These results indicate that 3,4-dihydro-2H-pyrans do not undergo a vinyl ether rearrangement to cyclobutyl intermediates when thermally decomposed but are probably degraded by some other mechanism, such as a reverse Diels-Alder type of reaction.

81 pages. $2.00. Mic 58-4070

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Abstract published by special arrangement with The Ohio State University.

DEGRADATION STUDIES ON CELLULAR CONSTITUENTS ISOLATED FROM STREPTOMYCES GRISEUS UTILIZING C^{14} LABELED CARBOHYDRATES

(Publication No. 24,626)

Jerzy Jozef Bialy, Ph.D.
Oregon State College, 1957

Major Professor: C. H. Wang

The catabolism of glucose and ribose in Streptomyces griseus was studied by means of tracer techniques.

Two general approaches were used in investigating the metabolic pathways of glucose and ribose in S. griseus.

First, specifically C^{14} labeled glucose, acetate and ribose were used in a series of time course studies in which the evolution of respiratory CO_2 from S. griseus cells was followed. The inventory of radioactivity among respiratory CO_2, incubation media and cellular constituents, in 12, 36 and 72 hours old cultures utilizing specifically labeled glucose in a proliferating medium was studied and the nature of fermentation products in the medium was also determined. In a similar series of glucose experiments, sodium arsenite was employed as a respiration inhibitor to study its effect on catabolic pathways. The nature of endogenous respiration was investigated by the time course study of the utilization of ordinary glucose by C^{14} labeled cells.

Based on the experimental evidence provided by these time course studies it was concluded that Embden-Meyerhof-Parnas glycolytic scheme was responsible for the breakdown of the bulk of glucose and that minor portion of glucose was catabolized by the phosphogluconate decarboxylation process. Subsequent quantitative estimation of pathways of glucose catabolism showed that 97% of glucose was catabolized glycolytically while the remaining 3% was oxidized directly. A complete change in pathway distribution was observed in the presence of sodium arsenite resulting in marked stimulation of phosphogluconate decarboxylation process. In the presence of external substrate endogenous respiration was stimulated in the early phase of the incubation. Time course studies on the utilization of ribose and acetate by this organism indicated that a ketolase type cleavage of ribose is probably operative.

Secondly, the nature of ribose catabolism in S. griseus was further studied by incorporating ribose-1-C^{14} into cellular matter which was subsequently subjected to a series of isolation schemes in order to determine the distribution of the substrate radioactivity among different constituents such as: Nucleic acids, fatty material, ribose and amino acids. It was found that ribose in nucleic acids contained 15% of activity, amino acids 70%, fatty material 4%, while only negligible amount of activity was detected in the glucose fraction. Cellular amino acids were further examined by two-dimensional paper-chromatography and radioautography for their respective label content. Aspartic acid and glutamic acid were found to contain over 40% of activity incorporated into the amino acid fraction. The latter two acids were degraded for the determination of the isotopic distribution patterns. The results obtained are in good agreement with the foregoing conclusion that ribose-1-C^{14} is catabolized mainly by way of a ketolase type cleavage reaction, yielding methyl labeled acetate and unlabeled pyruvate. 102 pages. $2.00. Mic 58-4071

A PARTIAL SYNTHESIS OF α-AMYRIN FROM GLYCYRRHETIC ACID

(Publication No. 25,201)

Edward Warren Cantrall, Ph.D.
University of Illinois, 1957

The α-amyrin series of triterpenes, one of the three principal series of pentacyclic triterpenes, has been the subject of numerous degradative investigations. In 1949 a structure was postulated for α-amyrin which differed from that of β-amyrin only in the disposition of methyl substituents at C_{19} and C_{20}.

A correlation of data from a number of degradative schemes together with chemical evidence derived from the differences in reactivity of α-amyrin derivatives compared with analogous β-amyrin derivatives confirmed that these compounds were identically constituted in rings A, B, C and D and that the stereochemical relationships at C_3, C_5, C_8, C_9, C_{10}, C_{14}, C_{17}, and C_{18} were the same in both substances.

A misinterpretation of acid catalyzed rearrangements of α-amyrin and its derivatives made with complete disregard for previously published experiments on ring E degradations led F. S. Spring and his co-workers to postulate an alternative structure for α-amyrin. This structure

represented α-amyrin as having a five-membered E ring with an isopropyl substituent.

Important experiments by O. Jeger in which the E ring of α-amyrin was separated from the rest of the molecule and that fragment was related via common intermediate to D(+)-pulegone led to the conclusion that ring E of α-amyrin was six-membered and that it possessed di-equatorial methyl substituents at C_{19} and C_{20}.

The synthesis of α-amyrin from glycyrrhetic acid, a β-amyrin derivative of known constitution and stereochemistry, is unambiguous proof that ring E of α-amyrin is indeed six-membered and that the methyl groups are both equatorially oriented and are located at C_{19} and C_{20} in ring E. This synthesis interrelates these two important groups of pentacyclic triterpenes and brings to a close the countless speculation regarding the structure of α-amyrin.

72 pages. $2.00. Mic 58-4072

A STUDY OF REACTIONS OF CIS- AND TRANS-CYCLOHEXANE-1,3-DIOLS

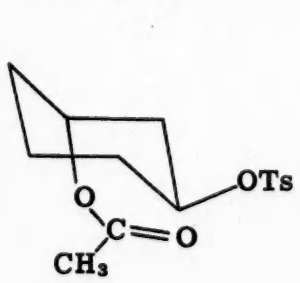
(Publication No. 23,580)

Harry Joseph Cenci, Ph.D.
University of Pennsylvania, 1957

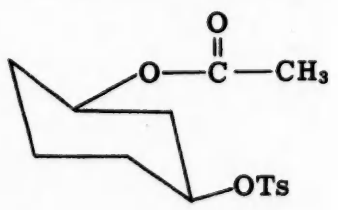
Supervisor: Dr. Frederick V. Brutcher Jr.

The primary object of this research was to investigate cis-and trans-cyclohexane-1,3-diol and several of its corresponding derivatives and to study the effect of having either two equatorial groups or one equatorial and one axial group in the 1,3-positions of the cyclohexane ring.

A study was made of the effect of the neighboring acetoxy group on the course of the replacement of the p-toluenesulfonate group of cis-and trans-3-acetoxycyclohexyl p-toluenesulfonate. As shown by the following structures, the acetoxy group in I should exhibit a neighboring group effect in the solvolysis of the tosylate group, while the corresponding acetoxy group in the cis-isomer, II,



I



II

would be incapable of exhibiting a neighboring group effect. I does indeed react under a variety of experimental conditions to give products which can best be explained on the basis of a neighboring acetoxy group, while the cis-isomer was shown to exhibit no neighboring group effect under identical reaction conditions.

A study was also made of the base induced cleavage of cis-and trans-3-hydroxycyclohexyl p-toluenesulfonate. Treatment of cis-3-hydroxycyclohexyl p-toluenesulfonate with base resulted in cleavage to hexen-5-al which under the reaction conditions aldol condensed to give 2(buten-3) octadien-2,7-al. The amount of cleavage was quantitatively determined by the use of infrared and ultraviolet spectra.

The kinetics of the reaction of both cis-and trans-3-hydroxycyclohexyl p-toluenesulfonate with methanolic potassium hydroxide at 30°C was found to follow second-order kinetics and the results of the kinetic experiments are given in Table I.

TABLE I

Summary of Velocity Constants

Reaction of 0.2000 Molar Potassium Hydroxide with 0.1000 Molar Cis-3-Hydroxycyclohexyl p-toluenesulfonate and with 0.0910 Molar Trans-3-Hydroxycyclohexyl p-toluenesulfonate in Methanol Solution at 30°C

Experiment Number	Velocity Constant k liters/mole min.	Combined Weighted Mean Velocity Constant k mean liters/mole min.
III Cis	.00588 ± .00009	.00597 ± .00015
IV Cis	.00606 ± .00010	
V Trans	.00108 ± .00004	.00113 ± .00007
VI Trans	.00117 ± .00007	

The products isolated from the reaction of cis-monotosylate with methanolic potassium hydroxide under the kinetic reaction conditions were a 2% yield of cyclohexen-3-ol and a 79% yield of hexen-5-al and its aldol condensation products. The products isolated from the reaction of the trans-isomer under the kinetic reaction conditions consisted of a 26% yield of a mixture of cyclohexen-3-ol and cyclohexen-4-ol, 58% of 2-(buten-3)octadien-2,7-al and 7% of unreacted starting material.

The acid catalyzed dehydration of both cis-and trans-cyclohexane-1,3-diol followed the normal dehydration process with both isomers giving approximately the same yields of 1,3-and 1,4-cyclohexadiene, cyclohexen-4-ol and cyclohexanone. Very little, if any, cleavage to hexen-5-al seems to have occurred under the reaction conditions used and no hexen-5-al or any of its aldol condensation products could be isolated or even detected.

A study of the acid catalyzed cleavage of 1,3-diphenyl-1,3-dihydroxy-2,2-dimethylhydrindene indicated that it cleaved to give an oil which on ozonization and hydrolysis gave o-dibenzoyl benzene and acetone.

179 pages. $2.35. Mic 58-4073

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THE SYNTHESIS OF 7-MEHTYL-3,4-BENZPYRENE, 6,7-DIMETHYL-3,4-BENZPYRENE, 10-METHYL-3,4-BENZPYRENE AND 7,10-DIMETHYL-3,4-BENZPYRENE

(Publication No. 22,924)

Joseph Leonard Comp, Jr., Ph.D.
The University of New Mexico, 1957

Chairman: Associate Professor Guido Herman Daub

The Friedel-Crafts succinoylation of 9,10-dihydrophenanthrene gave β-(9,10-dihydro-2-phenanthroyl)-propionic acid, which was converted in two steps to γ-(2-phenanthryl)-butyric acid (I). Cyclization of I gave 4-keto-1,2,3,4-keto-1,2,3,4-tetrahydrochrysene, which underwent a Reformatsky reaction with ethyl α-bromopropionate. Dehydration, hydrolysis and reduction of the Reformatsky product gave α-(1,2,3,4-tetrahydro-4-chrysenyl)-propionic acid, which was cyclized to 6-keto-7-methyl-6,7,7a,8,9,10-benzpyrene (II). Reduction, dehydration and dehydrogenation of II afforded 7-methyl-3,4-benzpyrene (10% over-all yield from phenanthrene).

The reaction of methyl magnesium iodide with II, followed by dehydration and dehydrogenation, gave 6,7-dimethyl-3,4-benzpyrene (6% over-all yield from phenanthrene).

2-Acetylphenanthrene, prepared in two steps from 9,10-dihydrophenanthrene, underwent the Stobbe condensation with diethyl succinate in the presence of sodium hydride to give a mixture of half-esters. The half-ester mixture was decarbethoxylated and reduced to γ-(2-phenanthryl)-valeric acid, which was cyclized to 4-keto-1-methyl-1,2,3,4-tetrahydrochrysene (III). The Reformatsky reaction of III with ethyl α-bromoacetate, followed by dehydration, hydrolysis and reduction of the hydroxy-ester thus produced, gave 1-methyl-1,2,3,4-tetrahydro-4-chrysenylacetic acid (IV). The acid IV was cyclized with anhydrous hydrogen fluoride to 6-keto-10-methyl-3,4-benzpyrene and this ketone upon reduction followed by dehydration and dehydrogenation afforded 10-methyl-3,4-benzpyrene (4% over-all yield from phenanthrene).

The Reformatsky reaction of III with ethyl α-bromopropionate, followed by dehydration, hydrolysis and reduction, gave α-(1-methyl-1,2,3,4,-tetrahydro-4-chrysenyl)-propionic acid (V). Cyclization of V with anhydrous hydrogen fluoride gave 6-keto-6,7,7a,8,9,10-hexahydro-3,4-benzpyrene, which upon reduction and dehydrogenation was converted to 7,10-dimethyl-3,4-benzpyrene (6% over-all yield from phenanthrene).

81 pages. $2.00. Mic 58-4074

I. AN UNEQUIVOCAL SYNTHESIS OF 2-LUPININE. II. STUDIES ON FUSED OXAZOLINES AND OXAZOLIDINES.

(Publication No. 25,202)

Kenneth Conrow, Ph.D.
University of Illinois, 1957

Part I.

In order to clarify a literature report on the preparation of 2-lupinine, authentic 2-lupinine has been prepared by a fourstep conversion from 2-carbethoxy-1-ketoquinolizidine. The proof of the skeleton of this compound was accomplished by relating it to an authentic sample of 2-methylquinolizidine.

The conversion of 2-carbethoxy-1-ketoquinolizidine to 2-lupinine took the following route: 1) reduction to 2-carbethoxy-1-hydroxyquinolizidine with sodium borohydride, 2) dehydration to 2-carbethoxy-Δ^1-dehydroquinolizidine with sulfuric acid-acetic acid or with phosphorous oxychloride-pyridine, 3) hydrogenation to 2-carbethoxyquinolizidine over platinum and 4) reduction to 2-lupinine with lithium aluminum hydride. 2-Lupinine was heated with fuming hydriodic acid to form the corresponding iodide hydriodide, which was reduced with lithium aluminum hydride to the known 2-methylquinolizidine. Attempted epimerization of 2-carbethoxyquinolizidine showed that it was the more stable epimer; accordingly, the 2-lupinine derived from it can be assigned the equatorial (α) conformation.

It was further shown that the compound resulting from the condensation of ethoxymethyl α-picolyl ketone with acetic anhydride, previously reported to be 2-ethoxymethyl-4-quinolizone, is actually 1-acetyl-3-ethoxypyrrocoline. The transformation products of this substance, including the reported "2-lupinine," have been reformulated on the basis of this new structural assignment.

Part II.

The alkaloids atisine, veatchine, cuauchichicine and garryfoline are known to undergo a facile isomerization to less basic substances whose dihydro derivatives are identical with the dihydro derivatives of the starting alkaloids. This isomerization has been described as an isomerization in the E and F rings involving scission of the oxazolidine ring, prototropic isomerization of the resulting ternary iminium salt and reclosure of the oxazolidine ring on the opposite side of the nitrogen atom from the original point of attachment. Since simple ternary iminium salts are not so readily isomerized, it was of interest to prepare a model of rings A, E and F and to study the isomerization with this compound.

The model compound, 6-aza-3-oxatricyclo[6.3.1.$0^{2,6}$]-dodecane, was prepared as follows: Dimethyl isophthalate was hydrogenated catalytically. The resulting mixture of dimethyl cis- and trans-1,3-cyclohexanedicarboxylates was reduced with lithium aluminum hydride to the mixed diols, which were converted to the p-toluenesulfonates. Monoethanolamine was alkylated with the oily mixture of tosylates and the intermediate 3-hydroxyethyl-3-azabicyclo[3.3.1]nonane was isolated by steam distillation in 23% overall yield. Room temperature oxidation of this material with mercuric acetate in 5% acetic acid gave the desired model compound.

The mechanism for the postulated isomerization involves abstraction of a proton at the methylene carbon atom of the ternary iminium salt form of the oxazolidine ring with simultaneous or subsequent addition of a proton at the old ternary carbon of the salt system. It is evident, then, that isomerization should be accompanied by deuterium exchange if it is carried out in a deuterated solvent. The demonstration that subjecting the model compound to a deuterated solvent under conditions which effect isomerizations in the alkaloids results in no deuterium exchange shows that no isomerization had occurred. Even under slightly more strenuous conditions (refluxing

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dioxane-deuterium oxide) only 30% of the molecules appear to have isomerized on the basis of the quantity of deuterium exchanged. These results were confirmed with a simpler model compound, 2-methyl-6-aza-9-oxabicyclo [4.3.0] nonane.

It appears that the prototropic isomerization of ternary iminium salts under mild conditions is not a universal phenomenon, and each new example must be discussed in its own terms. 132 pages. $2.00. Mic 58-4075

THE SYNTHESIS AND COMPARATIVE STUDY OF SOME QUATERNARY AMMONIUM IMIDES

(Publication No. 25,118)

Sister Mary Ambrose Devereux, S.N.J.M., Ph.D.
St. Louis University, 1957

The oldest known neuromuscular blocking agents are the curare alkaloids. The preparation of crystalline d-tubocurarine by King in 1935 and his subsequent elucidation of its structure has resulted in efforts on the part of Organic chemists to prepare other drugs with similar action. Although early experiments with curare had seemed to indicate that the drug had an effect on the central nervous system, the experiments of Claude Bernard established the peripheral locus of curare action as being at the neuromuscular junction.

It has been well established that acetylcholine is the chemical mediator of nerve impulse transmission at the neuromuscular junction, and it is generally assumed that this involves the attachment of the molecule to receptor sites on the surface of the effector organ. Presumably, compounds bearing some structural similarity to acetylcholine may also become attached to receptor sites and prevent acetylcholine from reaching the cell.

d-Tubocurarine and related compounds have two quaternary nitrogens separated by a distance of about 15 A^0, a distance which has been shown to be quite critical at the neuromuscular junction. The hypothesis has been advanced that d-tubocurarine and curare-like compounds block the receptors, preventing their union with acetylcholine. This blocking effect is in contradistinction to a depolarizing effect produced by other quaternary ammonium compounds such as decamethonium iodide which also paralyze motor nerve endings.

The present problem is a study in structure-activity relationship in certain quaternary ammonium derivatives of alkyl imides. The extensive work of Kimura, followed later by that of Seiwald and coworkers, has shown that quaternary ammonium derivatives of alkyl phthalimides exhibit a paralyzing activity greater than that normally associated with mono-quaternary ammonium compounds. Seiwald has also established that maximum potency in this type compound is associated with increased charge density of the quaternary nitrogen, and with a chain length range of n = 7, 8, 9. It was therefore considered profitable to study the effect on the curare-like activity caused by variation in the size and nature of the imide portion of the molecule. Naphthalimide and succinimide were chosen and the compounds prepared varied through n = 4, 6, 8, 10. Pyridine and N-methylpiperidine were the quaternizing agents.

The method of preparation of the intermediates was essentially a Gabriel synthesis, incorporating a condensation of the imide with specific dibromoalkanes. The quaternary derivatives were prepared by the interaction of the N-(ω-bromoalkyl)-imide with the appropriate amine.

The quaternary ammonium compounds were tested for specific peripheral paralyzing activity in frogs by lymph sac injection and the specificity of the paralysis at the neuromuscular junction was checked by direct and indirect stimulation of the sciatic nerve. Using the data obtained, chain length (n) was plotted against arbitrary activity units for the N-methylpiperidine derivatives of the phthalimide, naphthalimide, and succinimide series, and an interpretation of the difference in activity in the three series was attempted. The data obtained lends support to the equidistance hypothesis but does not rule out the possibility of screening effects.

In addition to the compounds already mentioned, a series of N-alkylnaphthalimides was prepared by reacting potassium naphthalimide with various alkyl halides. These compounds have sharp melting points and might easily be used as derivatives for the identification of alkyl halides.

80 pages. $2.00. Mic 58-4076

I. REACTION OF 2-AMINOPYRIDINE WITH α-HALOKETONES. II. THE EFFECT OF 3-SUBSTITUENTS ON THE OPTICAL STABILITY OF MESIDINE DERIVATIVES.

(Publication No. 25,207)

James Seward Dix, Ph.D.
University of Illinois, 1957

I. Reaction of 2-Aminopyridine with α-Haloketones

Unequivocal syntheses of 3-methylimidazo[1,2-a]pyridine and 3-phenylimidazo[1,2-a]pyridine have been achieved. The sodium salt of 2-aminopyridine was reacted with the ethylene glycol ketals of phenacyl bromide and bromoacetone. The resultant 2-alkylaminopyridine derivatives were treated with dilute hydrobromic acid to cleave the ketal grouping, and the products formed were then treated with acetic anhydride to effect cyclization. 2-Methylimidazo[1,2-a]pyridine and 2-phenylimidazo [1,2-a]pyridine were also prepared. The quaternary salts formed by reaction of 2-aminopyridine with the previously given ketals were treated with dilute hydrobromic acid, which cleaved the ketal grouping and allowed cyclization to occur immediately. 2-Phenylimidazo[1,2-a]pyridine was also synthesized by the cyclization and simultaneous oxidation of 1-(β-aminophenethyl)-2-pyridone with phosphorus oxychloride.

These results show that the reaction of 2-aminopyridine with either phenacyl bromide or bromoacetone yields a 2-substituted imidazo[1,2-a]-pyridine.

II. The Effect of 3-Substituents on the Optical Stability of Mesidine Derivatives

The study of optical stability in the 3-substituted N-benzenesulfonyl-N-carboxymethylmesidine series has been extended to include the tert.-butyl and methyl

derivatives. The half-life of the tert.-butyl compound when racemized in dimethylformamide at 118° was found to be 1.5 hours, and that of the methyl derivative to be 7.3 hours. It has been proposed that the inductive effect in this series is minor unless the 3-substituent has partial charge separation, as in the case of the nitro derivative. The conclusion has been made that steric effects can be present and that the optical stability of 3-benzylmesidine derivatives relative to other 3-substituted derivatives studied is a manifestation of a buttressing effect in the benzlyic compounds. The low half-life of the tert.-butyl derivative has been postulated to be the result of the existence in that compound of strain in the ground state due to steric factors, which is relieved in the transition state. The energy of the tert.-butyl derivative is assumed to be greater relative to unhindered compounds, but the transition state energies are assumed to be comparable, thus lowering the activation energy of the tert.-butyl compound.

Addendum. The Attempted Synthesis of Trichodesmic Acid

An attempt was made to form either cis or trans 2,3-dimethyl-4-isopropylglutaconic acid with the goal of hydroxylating the acid by a stereospecific agent to yield an acid identical with trichodesmic acid, the acid moiety of the Senecio alkaloid trichodesmine, thus establishing the structure and configuration of the natural acid. Empirically pure dimethyl-isopropylglutaconic acid was obtained by decarbethoxylation and hydrolysis of diethyl 2-isopropyl-3,4-dimethyl-4-carbethoxyglutaconate. The material was evidently a mixture of the isomeric cis and trans 2,3-dimethyl-4-isopropyl glutaconic acid and 2-isopropyl-3,4-dimethylglutaconic acid, and separation of the isomers was not accomplished. 166 pages. $2.20. Mic 58-4077

REARRANGEMENT OF SUBSTITUTED TRITYLHYDROXYLAMINES

(Publication No. 24,496)

Peter Marsland Hay, Ph.D.
The Ohio State University, 1951

Introduction

This work was undertaken to study the migration aptitudes of substituted aryl groups by means of a reaction different from the pinacol rearrangement, which Bachmann[1] used to study migration aptitudes.

The Stieglitz rearrangement[2] of tritylhydroxylamines,

$$XC_6H_4(C_6H_5)_2CNHOH \xrightarrow[\text{ether}]{PCl_5} XC_6H_4(C_6H_5)C{=}NC_6H_5 + (C_6H_5)_2C{=}NC_6H_4X$$

proved to be well suited to such a study, and three tritylhydroxylamines, in which X was equivalent to parachloro, paramethoxy, and paranitro, were prepared and rearranged. The resulting mixtures of products were analyzed to provide information on the migration aptitudes of the various groups. Results showed that in the Stieglitz rearrangement the migration aptitudes of p-$CH_3OC_6H_4$ C_6H_5, and p-ClC_6H_4 fall in the same order as they do in the Pinacol rearrangement.

Theoretical

The Stieglitz reaction of a compound $XC_6H_4(C_6H_5)_2CNHOH$ is held to proceed through one of two intermediate activated states, depending on which group migrates. Geometric factors, brought about by restriction of rotation through hydrogen bonding, may favor one of the activated states over the other. An electronic factor, related to stabilization by resonance of one activated state more than the other, is also considered. On the basis of these considerations, two migration aptitude series were set up.

Results and Conclusions

The results of the rearrangements of the three titylhydroxylamines, stated in terms of the percentage aniline in the mixture of two anilines found in the hydrolyzed products of the rearrangement, are as follows:

Methoxy analog	18 per cent† aniline
Chloro analog	77 per cent* aniline
Nitro analog	84 per cent* or 90 per cent † aniline

*By quantitative bromination of amine fraction.
†By quantitative infrared study of ketone fraction.

By using the formula,

$$\text{Migr. apt.} = \frac{2(100 - \text{aniline per cent})}{\text{aniline per cent}},$$

the following migration aptitudes were calculated from the above figures:

p-$CH_3OC_6H_4$	9.1†
C_6H_5	1.0
p-ClC_6H_4	0.6*
p-$NO_2C_6H_4$	0.4* or 0.2†

*By quantitative bromination of amine fraction.
†By quantitative infrared study of ketone fraction.

It is estimated that the precision of these results is one part in ten (i.e., 9.1 ± 0.9).

The following tabulation shows how the results of this study compare with the two migration aptitude series predicted on the basis of the geometric and electronic factors of the reaction and with the series derived from studies of the pinacol rearrangement.[3]

Predictions	Order of Migr. Apt. of XC_6H_4
Geometric bases	$H > CH_3 > Cl > NO_2$
Electronic bases	$CH_3O > H > Cl > NO_2$
Results	
Pinacol rearrangement	$CH_3O > H > Cl$
Stieglitz rearrangement	$CH_3O > H > Cl > NO_2$

From these results we conclude that the electronic factors are more important than the geometric factors, and that the pinacol and Stieglitz rearrangements occur by similar mechanisms. An indication that the geometric factors may be operative is that the absolute value for migration aptitude of p-$CH_3OC_6H_4$ is 400 in the pinacol reaction and 9 in the Stieglitz. 72 pages. $2.00. Mic 58-4078

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The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

2. Stieglitz, J., and Leech, P. N. "Molecular Rearrangement of Triarylmethylhydroxylamines," J. Am. Chem. Soc., 36 (Feb., 1914), p. 272.

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Abstract published by special arrangement with The Ohio State University.

DIANHYDRIDES OF D-FRUCTOSE AND L-SORBOSE

(Publication No. 24,063)

Hyrum Wayne Hilton, Ph.D.
The Ohio State University, 1952

When crystalline D-fructose (levulose) is dissolved in four parts of concentrated hydrochloric acid at 0° and is allowed to react for 72 hours, 40-45 per cent of the reaction product, after removal of the acid on an ion exchange resin, is unfermentable to yeast. From such a reaction Pictet and Chavan[1] isolated and characterized a crystalline compound ($C_{12}H_{20}O_{10}$) which was non-reducing to Fehling solution and resistant to acid hydrolysis, and which they designated diheterolevulosan. Molecular weight determinations and quantitative analysis for carbon and hydrogen established the dimeric dianhydride nature of the compound. The structure di-D-fructopyranose 1,2':2,1'-dianhydride was proposed by Schlubach and Behre[2] from methylation studies, and was proved by Wolfrom and Blair[3] by oxidation with sodium metaperiodate according to the general method of E. L. Jackson and C. S. Hudson[4].

Wolfrom and Blair[3] also isolated and characterized a second crystalline di-D-fructose dianhydride from the same reaction by chromatography on fuller's earth clay[5,6] which they designated diheterolevulosan II. The structure was proved to be D-fructopyranose-D-fructofuranose 1,2':2,1'-dianhydride by Wolfrom and Shilling[7] by identification of the oxidative hydrolysis products of its hexamethyl ether. Periodate analysis is not definitive for the structure.

A group of three related di-D-fructofuranose dianhydrides was isolated by R. F. Jackson and co-workers[8] from the unfermentable residue (5 per cent) left after the plant tuber reserve polysaccharide (polyfructan) inulin was hydrolyzed with dilute (0.0732 N) sulfuric acid at 49° for four hours. The compounds were designated difructose anhydrides I, II, and III in order of isolation, and the structures of difructose anhydrides I and III were shown to be di-D-fructofuranose 1,2':2,1'-dianhydride and di-D-fructofuranose 1,2':2,3'-dianhydride respectively. The structure of difructose anhydride II has not been definitely established.

In this work the reaction of D-fructose with four parts of concentrated hydrochloric acid at 0° to -5° for 72 hours was repeated, and an exhaustive and nearly quantitative chromatographic analysis on fuller's earth clay of the unfermentable residue was made. An amount of 28.7 per cent of the unfermentables was diheterolevulosan (herein designated diheterolevulosan I); 64.3 per cent was diheterolevulosan II, and 2.0 per cent was a new di-D-fructose dianhydride, designated diheterolevulosan III: soluble in water and insoluble in ethanol and methanol; non-reducing to Benedict reagent until after acid hydrolysis; m.p. 255-258°, $[\alpha]_D^{29}$ -179° (c 4, water); main x-ray powder diffraction lines[9], 6.64 (4), 5.02 (1), 4.69 (2), 4.26 (3), 2.82 (5); periodate assay: 3 moles of oxidant consumed with formation of one mole of formic acid and no formaldehyde per mole of reductant.

Diheterolevulosan III was further characterized as its crystalline hexaacetate; prisms from ether, m.p. 135.5-136.5°, $[\alpha]_D^{25}$ -169° (c 1, chloroform); main x-ray powder diffraction lines, 6.64 (2), 4.40 (1), 4.09 (3), 3.85 (5), 3.38 (4).

Rotational considerations[10] and periodate assay values made it appear probable that the new dianhydride was isomeric with diheterolevulosan II (D-fructopyranose-D-fructofuranose 1,2':2,1'-dianhydride), differing only in the configuration of one of the anomeric carbon atoms. Similar evidence was presented to suggest that the difructose anhydride II of Jackson and co-workers was anomeric with their difructose anhydride III (di-D-fructofuranose 1,2':2,3'-dianhydride).

Diheterolevulosans I and II have been found by x-ray powder diffraction techniques to exist in dimorphous forms, and interconversion of each from the metastable form (first form isolated) to the stable form was accomplished.

The remaining percentage of the unfermentable product was divided between fermentation glycerol (3.0 per cent) characterized as the crystalline tri-p-nitrobenzoate ester and the difructose anhydrides I (0.6 per cent) and II (1.4 per cent) of Jackson[8] obtained in crystalline form.

Five of the six known di-D-fructose dianhydrides were thus obtained from a single reaction mixture. Other trace components may and probably do exist in the mixture, although their combined amounts must be of the order of a few tenths of one per cent.

A reaction scheme for the formation of the di-D-fructose dianhydrides was proposed which involved the formation of an incipient carbonium ion which could react in the manner of glycoside (acetal) formation with a nonionized molecule to form an intermediate disaccharide. A second ionization and a second internal glycosidation was proposed to complete the dimerization to the comparatively acid stable dianhydride.

The action of cold concentrated hydrochloric acid on sugars was extended to a second ketohexose, L-sorbose. Unreacted L-sorbose was removed from the dimeric dianhydride mixture (43 per cent) by the carbon chromatography technique of Whistler and Durso[11]. Crystallization from methanol and purification of the crystalline and sirupy fractions by acetylation to two crystalline hexaacetates and deacetylation yielded two crystalline non-reducing di-L-sorbose dianhydrides, designated diheterosorbosan I and diheterosorbosan II, respectively, in a ratio of I/II:1/2.

Diheterosorbosan I was soluble in water, insoluble in methanol and ethanol; prisms, m.p. 249-250° (dec.), $[\alpha]_D^{27}$ -11.5° (c 3, water); main x-ray powder diffraction lines, 5.86 (3), 5.46 (2), 4.96 (1), 3.68 (5), 2.73 (4); periodate assay: 4 moles of oxidant consumed, 2 moles of acid formed, and no formaldehyde per mole of substance.

The periodate oxidation data established the structure of diheterosorbosan I uniquely as di-L-sorbopyranose 1,2':2,1'-dianhydride.

Diheterosorbosan I hexaacetate was soluble in benzene, chloroform and somewhat soluble in warm ether; needles,

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m.p. 168-169°, $[\alpha]_D^{21}$ + 3.66°, $[\alpha]_{5160}^{21}$ + 5.03° (c 3, chloroform); main x-ray powder diffraction lines, 8.51 (5), 5.40 (2), 4.76 (1), 4.39 (4), 4.03 (3).

Diheterosorbosan II was soluble in water and methanol, insoluble in ethanol; prisms, m.p. 188-189°, $[\alpha]^{26}$ 0.00° (c 1, water and methanol throughout the visible range of the spectrum); main x-ray powder diffraction lines, 6.39 (4), 5.13 (3), 4.78 (2), 4.49 (1), 3.22 (5); periodate assay: 3 moles of oxidant consumed, one mole of acid formed and no formaldehyde per mole of reductant.

By analogy to the di-D-fructose dianhydrides and from the periodate oxidation data, the structure L-sorbopyranose-L-sorbofuranose 1,2':2,1'-dianhydride is proposed for diheterosorbosan II. However, di-L-sorbopyranose 1,2':2,3'-dianhydride is not excluded.

Diheterosorbosan II hexaacetate was isolated as needles from absolute ethanol, m.p. 175.5-176°, $[\alpha]_D^{25}$ -19° (c 2, chloroform); main x-ray powder diffraction lines, 7.85 (3), 5.17 (2), 4.37 (1), 3.94 (4), 3.16 (5).

199 pages. $2.60. Mic 58-4079

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Abstract published by special arrangement with The Ohio State University.

KINETICS AND MECHANISMS OF ACIDIC HYDROLYSIS OF ARYL HYDROGEN ARYLPHOSPHONATES

(Publication No. 24,868)

Edward E. Jaffe, Ph.D.
New York University, 1957

Adviser: Professor Robert T. Morrison

We have studied the acidic hydrolysis of aryl hydrogen arylphosphonates from the standpoints of kinetics, effect of structure on reactivity, and behavior in highly acidic solutions.

The kinetics indicate that two kinds of reactions occur: uncatalyzed hydrolysis of the unionized ester, and acid-catalyzed hydrolysis of the unionized ester.

Catalyzed hydrolysis is favored by electron-withdrawing substituents in both the acid moiety and the phenol moiety. Uncatalyzed hydrolysis is favored by electron withdrawal in the phenol moiety and electron release in the acid moiety.

The behavior in highly acidic solutions suggests that both reactions involve participation by water in the rate-determining step.

On the basis of this evidence, we propose that catalyzed hydrolysis involves nucleophilic attack by water on phosphorus of the protonated ester, and that uncatalyzed hydrolysis involves intramolecular transfer of the acidic hydrogen to the aryl oxygen with simultaneous separation of the phenol and hydration of phosphorus.

182 pages. $2.40. Mic 58-4080

REACTION OF GRIGNARD REAGENTS WITH BROMOMAGNESIUM ENOLATES

(Publication No. 25,237)

Harrison Scott Killam, Ph.D.
University of Illinois, 1957

Action of Grignard Reagents on β-Substituted Propiomesitylenes.– The net effect of the reaction of phenylmagnesium bromide with β-methoxypropiomesitylene was the replacement of the ether function by the hydrocarbon radical of the Grignard reagent. In a similar manner mesitylmagnesium bromide converted the methoxy ketone to a compound in which the alkoxyl group had been replaced by a mesityl group. To facilitate identification of the liquid product of the former reaction, the solid p-chlorobenzal derivative was synthesized.

The desired reaction was also realized by treating 3-methoxyisopropenyl mesityl ketone with phenylmagnesium bromide. There were obtained in addition to the expected dibenzylacetomesitylene, small amounts of mesitoic acid and dibenzyl ketone. The formation of these compounds can be explained readily on the basis of an oxidative cleavage of one of the enolate intermediates in the reaction.

Attempts to replace a nitrile substituent in the beta-position of two propiomesitylenes were unsuccessful. 1-Mesityl-2-mesitoylpropionitrile was recovered unchanged even when treatment with the Grignard reagent was conducted at high temperatures. Phenylmagnesium bromide

was effective, however, in producing the enolate of a simpler nitrile derivative, β-cyanopropiomesitylene, although further reaction did not occur.

It was found impossible to effect a reverse Michael condensation by the action of the Grignard reagent on 1,3-dimesitoylpropane of 1-duroyl-3-mesitoylpropane. The displacement of an hydroxyl group from the beta-position of a propiomesitylene was also attempted. When 1,1-diphenyl-2-mesitoylethanol was allowed to react with phenylmagnesium bromide the compounds isolated were 1,1-diphenyl-2-mesitoylethylene and unchanged starting material. It is possible that the dehydrated product was formed during the hydrolysis of the reaction mixture rather than by an elimination reaction.

Addition of Phenylmagnesium Bromide to 2-Phenyl-4-benzoylfuran. – Previous investigations relating to the action of the Grignard reagent on β-aroylfurans show that the reaction involves opening of the furan ring. During the course of the present study the discovery was made that the phenyl Grignard reagent reacts with 2-phenyl-4-benzoylfuran in a completely different manner, the ring remaining intact. A mechanism is offered for the formation of the product, 2,5-diphenyl-3-diphenylhydroxymethyl-2,3-dihydrofuran. The removal of water from this compound was effected by heating the material briefly at its melting point or for a longer period in ethanol. In this way the carbinol was converted to a brilliant yellow compound, 2,5-diphenyl-3-diphenylmethylene-2,3-dihydrofuran. This furan was transformed by treatment with hydrochloric acid into an isomer in which the double bond was no longer exocyclic to the furan ring. That this compound was 2,5-diphenyl-3-diphenylmethylfuran was shown by an independent synthesis. Cyclodehydration converted 1,2-dibenzoylethane to 2,5-diphenylfuran, which was then alkylated with benzohydrol; both reactions were conducted in the presence of polyphosphoric acid.

In an attempt to investigate the scope of this reaction in which the heterocyclic ring remains intact the phenyl Grignard reagent was allowed to react also with 1,2-diphenyl-4-benzoylpyrrole. The results of these experiments were not decisive.

The Isomerization of 1,4-Dibenzoyl-1.4-dimesitoylbutane. – 1,4-Dibenzoyl-1,4-dimesitoylbutane was synthesized by two different routes. One reaction involved the addition of two equivalents of benzaldehyde to the dienolate of 1,4-dimesitoylbutane and then treatment of the dihydroxy diketone so obtained with chromic anhydride. The other synthesis was conducted by treating the dienolate with benzil. The cyclic diol, 1,4-dimesitoyl-2,3-diphenyl-2,3-cyclohexanediol, was then subjected to an oxidative cleavage reaction by treatment with periodic acid.

The butane derivatives, prepared in either manner, could be converted irreversibly into a higher melting isomer. This conversion was carried out by three different routes: prolonged boiling with ethanol, treatment with sodium methoxide at room temperature, and heating at reflux temperature with benzene. An analysis of available spectral data indicates that the low-melting and the high-melting compounds are diastereoisomers.

To explore the scope of this reaction two other ketones which possibly could exist in more than one diastereoisomeric form were synthesized. Neither 1,4-di(p-chlorobenzoyl)-1,4-dimesitoylbutane nor 1,3-di(p-toluyl)-1,3-dibenzoylpropane could be changed into an isomeric form, however. 122 pages. $2.00. Mic 58-4081

STUDIES IN STEREOCHEMISTRY: I. CHEMICAL CORRELATION OF (-)-6,6'-DINITRO-2,2'-DIPHENIC ACID AND (-)-6,6'-DIAMINO-2,2'-DIMETHYLBIPHENYL. II. STABILITY IN AIR OF SOME α-PHENYL KETONES.

(Publication No. 24,873)

Allan K. Lazarus, Ph.D.
New York University, 1957

Adviser: Professor Kurt Mislow

In a study of a number of optically active compounds in the hindered biphenyl series, a chemical correlation of the configurations of seven of these compounds has been achieved, by employing the following series of reactions: (-)-6,6'-dinitro-2,2'-diphenic acid was converted into (-)-methyl 6,6'-dinitro-2,2'-diphenate by esterification with methanol. On reduction of this ester with a mixture of lithium aluminum hydride and aluminum chloride, (-)-6,6'-dinitro-2,2'-bis(hydroxymethyl)biphenyl was obtained. When this dinitro-diol was subjected to catalytic hydrogenation, it was converted into (-)-6,6'-diamino-2,2'-bis(hydroxymethyl)biphenyl. The dinitro-diol, on refluxing with concentrated hydrobromic acid, afforded (-)-6,6'-dinitro-2,2'-bis(bromomethyl)biphenyl which, on reduction with a mixture of sodium borohydride and aluminum chloride in "diglyme," was converted into (-)-6,6'-dinitro-2,2'-dimethylbiphenyl. This latter compound, on catalytic hydrogenation, gave (-)-6,6'-diamino-2,2'-dimethylbiphenyl.

As a result of this work, two of the most important compounds in the biphenyl series, (-)-6,6'-dinitro-2,2'-diphenic acid and (-)-6,6'-diamino-2,2'-dimethylbiphenyl, were shown to have the same configuration.

In a study of the air stability of 2-phenylcyclopentanone, the course of the air oxidation of this compound to γ-benzoylbutyric acid has been followed by means of ultraviolet spectral curves obtained during the oxidative decomposition of the cyclic ketone. In so doing, the ultraviolet spectrum of each of the pure compounds has been obtained, and the semicarbazone of each of these ketones has been prepared; in each case, the results have served to clarify the discrepancies which exist in the literature. It has also been shown that in a mixture of 2-phenylcyclopentanone and γ-benzoylbutyric acid, the amounts of each of the compounds present may be determined by an analysis of the ultraviolet spectrum of the mixture.

The rotatory dispersion spectrum of (+) - 3 - phenyl - 2 - butanone has been obtained by an examination, at seven wavelengths, of the optical rotation of this ketone in cyclohexane and in toluene.

In an attempt to repeat earlier work on the Beckmann rearrangement of (+) - 3 - phenyl - 2 - butanone oxime, it was found impossible to prepare a crystalline oxime according to the method given. In the light of additional evidence which has been brought forward, strong doubt must be expressed as to the validity of the claim that the

Beckmann rearrangement of oximes has been demonstrated to proceed with retention of asymmetry in the migrating group. 71 pages. $2.00. Mic 58-4082

PART I. STEREOCHEMISTRY AND ENERGY OF ACTIVATION OF DIMERIZATION OF α-PHENYLETHYL RADICALS. PART II. MECHANISMS OF REACTIONS BETWEEN GRIGNARD REAGENTS AND α-PHENYLETHYL HALIDES.

(Publication No. 24,875)

Carl Edward Lorenz, Ph.D.
New York University, 1957

Adviser: Professor Robert T. Morrison

Part I

tert-Butyl peroxide and acetyl peroxide have been decomposed thermally and photochemically in ethylbenzene at temperatures ranging from 43° to 135°. The 2,3-diphenylbutane thus formed has been analyzed for the proportions of meso and racemic isomers. The results indicate that dimerization of alpha-phenylethyl radicals to the racemic isomer has an energy of activation 1.9 kcal. higher than dimerization to the meso isomer; dimerization to the racemic isomer has, however, a more favorable steric factor. Both these effects are shown to be consistent with the structures involved.

Part II

Reactions of ethylmagnesium bromide with alpha-phenylethyl chloride and alpha-phenylethyl bromide, both optically inactive and optically active, have been carried out, and the products analyzed. There are formed 2,3-diphenylbutane, sec-butylbenzene, ethylbenzene, tar, ethane, ethylene, and butane.

From inactive chloride and bromide there is obtained diphenylbutane of the same stereochemical composition as that obtained at the same temperature from ethylbenzene and peroxides; for the chloride, this agreement of stereochemical composition was found to hold over a temperature range of 100°. From optically active chloride and bromide, inactive diphenylbutane is obtained; in contrast, the reaction of alpha-phenylethylmagnesium chloride and active alpha-phenylethyl chloride is found to yield diphenylbutane. alpha-Phenylethyl halides are found to form diphenylbutane faster than the corresponding benzyl halides.

On the basis of this evidence, it is proposed that diphenylbutane is formed by dimerization of free alpha-phenylethyl radicals formed by homolysis of a complex between Grignard reagent and organic halide.

From optically active chloride and bromide there is obtained sec-butylbenzene of opposite configuration and much lower optical purity. Comparison of the rates of reaction with the rates of racemization by bromide ion show that some racemization accompanies the Grignard reaction itself. alpha-Phenylethyl halides are found to undergo alkylation faster than the corresponding benzyl halides.

On the basis of this evidence, it is proposed that sec-butylbenzene is formed by SN-1 displacement of halide by the alkyl group of the Grignard reagent.

It was observed that the proportions of the various products obtained from optically active bromide are markedly different from those obtained from inactive bromide. When active bromide is used, the yield of sec-butylbenzene increases two-fold, the yield of diphenylbutane decreases to one-third its former value, and the yield of tar decreases to one-half its former value. The stereochemical composition of the diphenylbutane changes, the proportion of meso isomer decreasing. If these changes are actually stereochemical, and not caused by some kind of catalysis by an unknown impurity, they are most unusual. Although no satisfactory explanation is offered, certain implications of these findings are discussed.

130 pages. $2.00. Mic 58-4083

THE STEREOCHEMISTRY OF THE 2,3-DICHLORO-p-DIOXANES

(Publication No. 24,910)

Hans Edmund Lunk, Ph.D.
Northwestern University, 1957

2-Chloro-p-dioxene has been prepared from 2,3-dichloro-p-dioxane by reaction with diethylaniline. Addition of hydrogen chloride produced 2,2-dichloro-p-dioxane, the structure of which was proved by hydrolysis to p-dioxanone, and by reaction with phenylmagnesium bromide to give 2,2-diphenyl-p-dioxane.

2,2-Dichloro-p-dioxane is not identical with a compound, m.p. 53°, which had been obtained previously by chlorination of p-dioxane in carbon tetrachloride, and to which this structure had been assigned erroneously. The structure of the 53° compound was shown to be that of 2,3-dichloro-p-dioxane by its hydrolysis to ethylene glycol and glyoxal.

The trans configuration of the 31° isomer of 2,3-dichloro-p-dioxane has been shown by a kinetic resolution with brucine, yielding optically active 2,3-dichloro-p-dioxane. The 53° isomer must therefore be assigned the cis configuration.

cis-2,3-Dichloro-p-dioxane was converted to the trans isomer by heating to temperatures above 100°, by heating with thionyl chloride, or by treatment with aluminum chloride. The hydrolysis reaction of cis-2,3-dichloro-p-dioxane in 50% aqueous dioxane at 25° is fourteen times faster than that of the trans isomer.

The addition of chlorine to p-dioxene by means of iodobenzene dichloride resulted in the formation of over 95% of trans-2,3-dichloro-p-dioxane contrary to the reported cis specificity of the reagent. Molecular chlorine gave rise to mixtures of cis- and trans-2,3-dichloro-p-dioxane, the ratio of the two isomers depending on the polarity of the solvent. Nonpolar solvents favor the formation of the cis isomer.

In the chlorination of p-dioxane in carbon tetrachloride solution at -10°, the intermediate monochloro-p-dioxane builds up to a concentration of at least 34%. This has been shown by reaction of the chlorination product with phenylmagnesium bromide and spectrophotometric determination of monophenyl-p-dioxane.

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Three new trichloro-p-dioxanes have been prepared: Addition of chlorine to 2-chloro-p-dioxene gives rise to 2,2,3-trichloro-p-dioxane, m.p. 21°, whereas low temperature chlorination of cis- and trans-2,3-dichloro-p-dioxane results in the formation of 2,3,5-trichloro-p-dioxanes, m.p. 70° and 41°, respectively.

2-Chloro-3-acetoxy-p-dioxane, prepared from 2,3-dichloro-p-dioxane and acetic acid in toluene solution, has been pyrolyzed to give p-dioxanone and acetyl chloride. An analogous reaction, the treatment of 2,3-dichloro-p-dioxane with anhydrous formic acid at 170°, was used for a novel preparation of p-dioxanone. The thermal decomposition of 2-acetoxy-3-chlorotetrahydropyran, prepared from 2,3-dichlorotetrahydropyran and acetic acid, did not give products analogous to those in the pyrolysis of the p-dioxane derivatives. An elimination of acetic acid occurred, the other product of the reaction being 3-chlorodihydropyran. 96 pages. $2.00. Mic 58-4084

THE SYNTHESIS AND ANTIMICROBIAL ACTIVITY OF CERTAIN PEPTIDES

(Publication No. 24,915)

Saul Ben Needleman, Ph.D.
Northwestern University, 1957

The major aspect of the current work dealt with the synthesis of peptide derivatives which might be inhibitors of glycolytic enzymes leading to lactic and pyruvic acids. Since these acids are known to solubilize dental enamel in teeth, the inhibition of their formation should result in the prevention or diminution of dental caries.

Towards this end a number of techniques for the synthesis of peptides were investigated. Despite certain relatively simple methods for synthesis which have recently become available, the preparation of peptides, especially beyond the dipeptide stage, is not yet readily accomplished. Older techniques using acyl chlorides with free or esterified amino acids frequently led to the formation of large amounts of polymerized products. These substances could not be resolved into pure peptides of known composition. Phthalic anhydride proved satisfactory for blocking the amino group and together with N,N-dicyclohexylcarbodiimide as the coupling agent, afforded the best technique used in the present study. Several trifunctional amino acids were so treated that each functional group was blocked differently to allow for the selective incorporation of any of the functions into the peptide linkage. Considerable experience was necessary in order to obtain reasonable yields. The choice of solvents and procedures attending the isolation, purification and crystallization were additional factors contributing to the overall yield.

By the test procedure used, a large number of the peptides and peptide derivatives prepared in this work were active in reducing the formation of lactic or pyruvic acid in glycolysis as compared with a blank preparation. Fresh caries active saliva as the source of enzymes together with measured quantities of glycose and tricalcium phosphate comprised the Fosdick test mixture. The effectiveness of any peptide as an inhibitor was measured by the degree of solubilization of the calcium phosphate as determined by permanganate titration of calcium oxalate formed after incubation of the mixture and precipitation of the soluble calcium with ammonium oxalate.

While a high degree of inhibition was exhibited by many peptides under these experimental conditions, it is not certain whether comparable reduction in caries might be achieved by incorporation of these materials in foods containing fermentable carbohydrats. Since an infinite number of peptides could be prepared from amino acids selected purely on an empirical basis, it was attempted to obtain some understanding of the nature of the inhibition mechanism by restricting the synthesis of peptides to sequences occurring with reasonable frequency in natural peptides. An investigation of physiologically active peptides whose amino acid sequences have been elucidated was undertaken in order to discern the possible existence of non-randomly distributed sequences. Towards this end, models of the peptides were prepared from plastic "poppit" beads. The frequency with which any amino acid occurred adjacent to a reference amino acid was recorded. When a particular amino acid was found as part of a sequence to a greater extent than could be predicted purely by statistical chance from its average total distribution, this sequence was considered to comprise a non-random structure, i.e., a preferred sequence. The biological activity of these peptides might be related in some manner to the presence of these groupings. However, in the present work, too few peptides were prepared to allow for any reasonable coordination between sequence and degree of inhibition activity. At the present state of this work it was not possible to determine which of the many enzymes of glycolysis were inhibited by any particular synthetic peptide. Perhaps a more informative approach to the problem would involve an investigation of the effect of each peptide on preparations of individual glycolytic enzymes. In this manner, structural sequences of the peptides would assume significance in relation to their effectiveness as inhibitors.

145 pages. $2.00. Mic 58-4085

THE MECHANISM OF THE ALKALINE HYDROLYSIS OF ALPHA HALO SULFONES AND THE STEREOCHEMISTRY OF THE FREE RADICAL ADDITION OF THIOLACETIC ACID AND HYDROGEN BROMIDE TO CIS AND TRANS 2-CHLORO-2-BUTENE

(Publication No. 24,916)

Norman Paul Neureiter, Ph.D.
Northwestern University, 1957

The gaseous product of the reaction of ethyl 1-chloroethyl sulfone with a 2 N potassium hydroxide solution was analyzed by an infrared technique and shown to consist of 80 ± 3% cis-2-butene and 20 ± 3% trans-2-butene. The alkaline hydrolysis of 1-chloroethyl propyl sulfone likewise resulted in preferential formation of cis-2-pentene.

In the desulfuration of episulfides with phenyllithium it has been shown that cis-2-butene sulfide gives rise to exclusively cis-2-butene (and lithium phenyl mercaptide), and trans-2-butene sulfide gives only trans-2-butene. This corresponds to a stereoselective cis elimination of the sulfur atom. Utilizing the analogy of the episulfide ring cleavage to the cleavage of the episulfone ring

postulated as intermediate in the conversion of alpha halo sulfones to olefins with base, some stereochemical aspects of the sulfone hydrolysis reaction are discussed. A theory is proposed to account for the remarkable preferential formation of the thermodynamically less stable cis isomers. A complete survey of the literature on the hydrolysis of alpha halo sulfones has been included.

Thiolacetic acid has been added to cis- and trans-2-chloro-2-butene in light catalyzed reactions at -78°. At this temperature there was no pre-addition isomerization of the chlorobutenes. The product from both the cis and the trans chlorobutenes consisted of mixtures of about 90% threo- and 10% erythro-2-acetylmercapto-3-chlorobutane. The similarity of the mixtures obtained from the cis and the trans chlorobutenes suggests that the free radical addition of thiolacetic acid to acyclic olefins is not stereospecific, and that the same chain-carrying intermediate radical is formed from either a cis or trans olefinic substrate. This observation provides strong evidence against the existence of a bridged radical intermediate of any but perhaps a transient nature.

With ultraviolet irradiation hydrogen bromide in petroleum pentane solution rapidly isomerized cis- and trans-2-chloro-2-butene prior to addition, even at -78°. At ordinary temperatures thiolacetic acid produced isomerization of either the cis or trans chlorobutene to identical equilibrium mixtures containing about 20% of the cis isomer. Isomerization is presumably caused by addition of the acetylmercapto or bromine radical followed by rapid elimination before hydrogen abstraction by the intermediate radical has had time to occur.

The isomerization of olefins with thiolacetic acid has been investigated. The significance of the failure to observe stereospecificity in the addition of thiolacetic acid to acyclic olefins has been discussed in terms of electronic structure. 129 pages. $2.00. Mic 58-4086

THE SYNTHESIS OF CANALINE, CANAVANINE AND RELATED COMPOUNDS

(Publication No. 24,647)

David Dolph Nyberg, Ph.D.
Oregon State College, 1957

Major Professor: Bert E. Christensen

A brief review of the discovery, occurrence, isolation and properties of canavanine and canaline is presented along with a brief description of earlier work on the synthesis of these amino acids.

A general discussion of the most satisfactory methods of preparation of O-substituted hydroxylamines and hydroxyguanidines is given.

A new and practical synthesis of DL-canaline by a five-step reaction scheme from γ-butyrolacetone in seven percent overall yield is described. DL-Canavanine is prepared directly from DL-canaline.

An attempt to synthesize the lower homologue of DL-canaline resulted only in the isolation of DL-serine. An interesting material believed to be a polyoxime appeared as a product in this investigation.

The bromination of δ-valerolactone gave what is probably a mixture of 2,5-dibromovaleric acid and α-bromo-δ-valerolactone. This made it impractical to synthesize the higher homologue of DL-canaline from δ-valerolactone using the identical scheme as that used for DL-canaline.

55 pages. $2.00. Mic 58-4087

THE APPLICATION OF THE FAVORSKI REARRANGEMENT TO THE PRODUCTION OF A-NORSTEROIDS IN THE PREGNANE SERIES AND THE CHEMICAL STUDIES OF THE REACTIONS OF β-CHOLESTANYL P-TOLUENE SULFONATE WITH ALCOHOLS AND SODIUM ALKOXIDES IN ALCOHOLS

(Publication No. 23,450)

Nicholas Pappas, Ph.D.
Brown University, 1957

PART I

Pregnenolone was converted to A-norallopregnane-2, 20-dione in the following manner. Pregnenone was reduced catalytically to pregnanolone which was oxidized to allopregnane-3,20-dione. Allopregnane-3,20-dione was brominated to give 2α-bromo allopregnane-3,20-dione which was converted by the Favorski Rearrangement to a mixture of 2- and 3- carbomethoxy A- norallopregnane-20-one. This mixture was converted to a mixture of 2- and 3- carbomethoxy A- norallopregnane-20-ethylenethioketal which was reduced to 2- and 3- methylol A-norallopregnane-20-ethylenethioketal. The 2-isomer was separated and oxidized to 2-methylal A-norallopregnane-20-ethylenethioketal. Treatment of the latter with phenyl magnesium bromide followed by removal of the ethylenethioketal group gave the 2-phenylcarbinol of A-norallopregnane-20-one. The latter was dehydrated to the 2-phenylethylene of A-norallopregnane-20-one which was oxidized to A-norallopregnane-2,20-dione.

PART II

The reaction of β-cholestanyl tosylate with sodium methoxide in metahnol gave the same yields of Δ^{2-} and Δ^{3-}cholestene and α-cholestanyl methyl ether as obtained when methanol alone was used. Since the rate of reaction was shown by J. A. Meschino[1] to be unaffected by sodium methoxide and only the α-methyl ether is formed, a mechanism involving the solvolysis of the tosylate to give a covalently solvated secondary carbonium ion as the rate determining step has been proposed.

The reaction of β-cholestanyl tosylate with t-butyl alcohol and sodium t-butoxide in t-butyl alcohol gave a much higher ratio of Δ^{2-} and Δ^{3-}cholestenes to α-cholestanyl t-butyl ether than the methanol case. The configuration of α-cholestanyl t-butyl ether was established by its hydrolysis to α-cholestanol.

138 pages. $2.00. Mic 58-4088

1. J. A. Meschino, Sc.B. Thesis, Brown University, (1954).

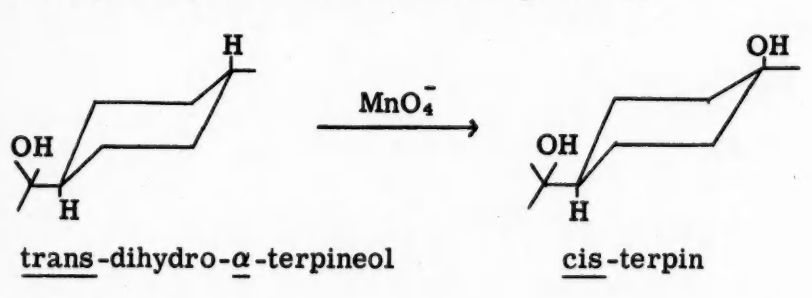
THE PERMANGANATE OXIDATION OF TERTIARY ALCOHOLS

(Publication No. 25,384)

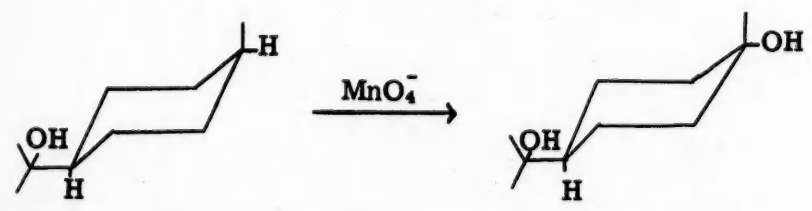
Ross Albers Quinn, Ph.D.
Stanford University, 1957

F. C. Green[1] noted that in the reaction of alkaline potassium permanganate solution with a bicyclic terpene alcohol under room conditions, a tertiary hydrogen was converted in high yield into a tertiary hydroxyl group. The problem then was to establish whether or not the reaction in which a tertiary hydrogen is converted to a hydroxyl group by permanganate is a more general reaction, and, if so, what must be the structural features of an organic compound for it to undergo the reaction with permanganate.

The isomeric dihydro-α-terpineols were prepared, and then separated by fractional distillation into the pure cis- and pure trans-forms. Measurement of the physical properties of the pure isomers and their phenylurethane derivatives clarified the conflicting data reported by various workers, and confirmed the configurational assignments made through application of the Auwers-Skita rule. Further support for the assigned configurations was obtained by preparing, and measuring the properties of, the nitrous acid esters of the cis- and trans-dihydro-α-terpineols. The cis-dihydro-α-terpineol was converted to trans-terpin by reaction with alkaline potassium permanganate solution, whereas trans-dihydro-α-terpineol was converted to cis-terpin by reaction with the same reagent. Thus, the reaction, noted by F. C. Green has been shown to be a more general reaction, and also has been shown to be stereospecific, with retention of configuration.



trans-dihydro-α-terpineol cis-terpin



cis-dihydro-α-terpineol trans-terpin

The reaction was further generalized to include acyclic compounds. The acyclic alcohols 2,5-dimethyl-2-hexanol and 2,4-dimethyl-2-pentanol were prepared, and then converted by reaction with potassium permanganate solution to the corresponding ditertiary diols, 2,5-dimethyl-2,5-hexanediol and 2,4-dimethyl-2,4-pentanediol, respectively.

It was established that a hydroxyl group is a necessary structural feature of a compound for the oxidation of the tertiary hydrogen to hydroxyl to take place. Methylcyclohexane and 2,2,4-trimethylpentane were treated with potassium permanganate solution, and the relative inertness to the reagent shown by these two compounds, compared to the ease with which compounds with hydroxyl groups were oxidized, demonstrated the necessity that a hydroxyl group be present.

The compound, tertiary methyl fenchyl alcohol, in which the tertiary hydrogen is located at a bridge-head carbon atom, was prepared, and then oxidized by potassium permanganate solution. In this case, the evidence indicated that the tertiary hydrogen was not oxidized to a hydroxyl group.

The isomeric 1,3-dimethylcyclohexanols were prepared, and then separated by fractional distillation. Each isomer was oxidized by potassium permanganate solution to yield different diols, which were shown to be isomers of 1,3-dimethyl-1,3-cyclohexanediol, again demonstrating the stereospecificity of the reaction. The cis-1,3-dimethyl-1,3-cyclohexandeiol was characterized by the preparation of a cyclic borate derivative. The trans-isomer did not form a borate derivative, dehydration taking place instead. On the basis of the stereospecificity with retention of configuration shown in the oxidation of the dihydro-α-terpineols by potassium permanganate, it follows that the precursor to the cis-1,3-dimethyl-1,3-cyclohexanediol is the cis-1,3-dimethylcyclohexanol. Similarly, the precursor to the trans-1,3-dimethyl-1,3-cyclohexanediol must be the trans-1,3-dimethylcyclohexanol. The configurations for the 1,3-dimethylcyclohexanols thus deduced are just opposite those assigned by Chiurdoglu[2] on the basis of the Auwers-Skita rule.

Further information must be obtained before a satisfactory mechanism for the reaction of potassium permanganate with the tertiary hydrogen of an organic compound to yield a hydroxyl group can be proposed.

94 pages. $2.00. Mic 58-4089

1. Green, F. C., The Isolation and Characterization of a New Alcohol from American Peppermint Oil, Doctoral thesis, Stanford University, March, 1950.
2. Chiurdoglu, G., Bull. soc. chim. Belg., 47, 241 (1938).

POLYMERIC PHTHALOCYANINES

(Publication No. 25,269)

John Hancock Rassweiler, Ph.D.
University of Illinois, 1957

Linear polymers of copper, mixed copper-molybdenum and molybdenum phthalocyanine were prepared by the usual procedures for the synthesis of metal phthalocyanines. The polymers were prepared by the use of a one to three molar ratio of pyromellitic acid to phthalic anhydride and of 3,3',4,4'-tetracarboxydiphenyl ether to phthalic anhydride.

The polymers were characterized as linear by their ready solubility in dimethylformamide and pyridine and by their relative viscosities. The viscosities were taken in dimethylformamide and in chloroform, when the polymers were made soluble by reversible oxidation. The metal phthalocyanine character of the polymers was confirmed by infrared and visible spectra. The elemental analysis, as had been reported in previous work, was unsatisfactory.

The polymers were not flexible, but were obtained as blue-green to black powders. The polymers were completely stable at 215°C./11 mm. for long periods. When loss of weight in air at 350° C. was recorded, the linear polymers were nearly twice as stable as sheet

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polymers, made from pyromellitic acid, or copper phthalocyanine.

3,3',4,4'-Tetracarboxydiphenyl ether was prepared by the Williamson coupling of 3,4-dimethyl phenol and 4-bromo-o-xylene, followed by a potassium permanganate oxidation. Another monomer, 2,2-bis(3,4-dicarboxydiphenyl) butane was prepared but not used in polymerization. A large number of intermediates were prepared in the investigation of several other possible tetrasubstituted diaryl compounds capable of forming polymeric phthalocyanines.

The preparation of the following new compounds is described in this thesis: Trans-1,2-dicyano-4-mercaptocyclohexane, 3,3'-dicarboxy-4,4'-diiododiphenylmethane, 2,2-bis(3,4-dimethylphenyl) butane, 2,2-bis (3,4-dicarboxyphenyl)butane, 3,3',4,4'-tetracarboxydiphenyl ether, linear pyromellitic acid – phthalic anhydride phthalocyanine polymer containing copper, molybdenum and a mixture of the two, linear 3,3',4,4'-tetracarboxydiphenyl ether-phthalic anhydride phthalocyanine polymer containing copper and a mixture of copper and molybdenum.

117 pages. $2.00. Mic 58-4090

THE EFFECT OF SUBSTITUENT GROUPS UPON THE BASIC STRENGTH OF p-AMINODIPHENYLACETYLENE

(Publication No. 25,134)

Sister Mary Maynard Rhodes, S.S.N.D., Ph.D.
St. Louis University, 1957

Chairman: Professor Kenneth Howard Adams

According to the principle of vinylogy, the transmission of electrical effects from a substituent X to some functional group Y in the molecule is greater in magnitude if X and Y are separated by an unsaturated system (X–Ć=Ć–Y) or a conjugated system (X–(Ć=Ć)$_n$–Y) than if the intervening structure is saturated (X–(CH$_2$)$_n$–Y). The purpose of this investigation was to measure in a quantitative way electrical transmissions through the diphenylacetylene nucleus (X–ϕ–C≡C–ϕ–Y) in order to compare the efficiency of the triple bond with that of the double bond of the stilbene nucleus (X–ϕ–Ć=Ć–ϕ–Y) in transmitting such group perturbations. Because an amino group with its unshared pair of electrons can enter into conjugative coupling with an aromatic nucleus, it is especially sensitive to an increase or decrease in the electron density of the latter brought about by the introduction of substituent groups on the benzene ring. Therefore a new series of m'- and p'-derivatives of p-aminodiphenylacetylene was synthesized and their ionization constants measured in 95% ethanol.

Spectrophotometric measurements were used to evaluate the ionization constants according to the equation

$$K_a = \frac{E_A - ES}{E_N - E_A} [HCl]$$

where E_N, E_S, and E_A represent the molar extinction coefficients of solutions of the free base, the conjugate acid, and a mixture of the two, respectively. [HCl] is the molar concentration of acid in the solution containing the free base and conjugate acid forms.

When the ionization constants so determined are expressed in terms of pK_a units and plotted against the established Hammett sigma values for the various substituents under study, a straight line of slope 0.46 is obtained as compared to the value of 0.39 determined for the stilbene series in an earlier investigation in our laboratory. The triple bond, therefore, is only slightly more effective than the double bond in transmitting electrical effects through a conjugated system.

106 pages. $2.00. Mic 58-4091

EXPLORATORY STUDIES ON A GENERAL METHOD FOR SYNTHESIS OF POLYCYCLIC COMPOUNDS CONTAINING NITROGEN

(Publication No. 25,337)

Alberta Barkley Ross, Ph.D.
University of Maryland, 1957

Supervisor: Professor Nathan L. Drake

Development of a general method for synthesis of polycyclic nitrogen compounds has been undertaken and two new hydroindoles were prepared. The proposed synthetic method makes use of nitrocyclohexenes, which have been obtained in good yield by the Diels-Alder reaction of dienes with 1-nitro-1-alkenes.

The reaction of 2,3-dimethyl-1,3-butadiene, $CH_2=C(CH_3)-C(CH_3)=CH_2$, with substituted nitroethylenes, $RCH=CHNO_2$, at 100° for 8 to 40 hr., was used for preparation of a series of 4-alkyl-1,2-dimethyl-5-nitrocyclohexenes. The yields were: R = $-CH_3$, 68.5-72%; $-C_2H_5$, 77.5%; $-C_3H_7$-n, 69.5%; $-CH(CH_3)_2$, 31.5-35%; $-C_4H_9$-n, 73%; $-CH_2CH(CH_3)_2$, 65-68.5%; $-C_5H_{11}$-n, 65%; $-C_6H_{13}$-n, 77-78%; $-CH_2CH_2OC_2H_5$, 69-80.5%. The low yield obtained when R was an isopropyl group was attributed to steric inhibition of the reaction; reactivity of the nitroethylene substituted with an isobutyl group was about the same as with those containing unbranched substituents.

The nitrocyclohexenes were readily converted to the dibromides, which were low melting solids, in almost quantitative yields. The preparation of 6-alkyl-3,4-dimethyl-2-cycl ohexen-1-ones was carried out by the Nef reaction from the corresponding nitrocyclohexenes where R = $-C_4H_9$-n and $-CH_2CH_2OC_2H_5$. Evidence for the shift of the double bond into conjugation with the carbonyl group was found in the ultraviolet spectra of the ketones: λ_{max} = 226 mμ (ϵ = 11,800 and 10,800).

The reaction of 2-methoxybutadiene, $CH_2=C(OCH_3)-CH=CH_2$, with 4-ethoxy-1-nitro-1-butene, $C_2H_5OCH_2CH_2CH=CHNO_2$, at 100° for 6 hr., gave 4-(2-ethoxyethyl)-2-methoxy-5-nitrocycl ohexene in 56% yield. The adduct, which is an enol ether, was hydrolyzed to 3-(2-ethoxyethyl)-4-nitrocyclohexanone in 97.5% yield. The products from the reaction of the latter with diazomethane were separated by chromatographing on alumina and analysis of the fractions by their infrared spectra. An overall yield (based on adduct) of 52% ketone and 27% epoxide was obtained; the ketone was formulated as 4(or 3)-(2-ethoxyethyl)-5(or 4)-nitrocycloheptanone and the epoxide as 5-(2-ethoxethyl)-6-nitro-1-oxaspiro[2.5]octane.

Hydrogenation of the nitrocyclohexenes by the use of a palladium catalyst gave high yields of the corresponding cyclohexylamines. When 2-(2-ethoxyethyl)-4,5-dimethylcyclohexylamine was treated with hydrobromic acid, 2-(2-bromoethyl)-4,5-dimethylcyclohexylamine hydrobromide

was isolated in 87% yield and cyclized (64%) by dilute sodium hydroxide to octahydro-5,6-dimethylindole.

2-(2-Ethoxyethyl)-4-methoxycyclohexylamine was also treated with hydrobromic acid; cyclization of the 4-bromo-2-(2-bromoethyl)-cyclohexylamine hydrobromide with dilute sodium hydroxide gave an overall yield of 68% of an amine, formulated as either 2,3,3a,4,7,7a-hexahydro- or 2,3,3a,6,7,7a-hedahydroindole.

158 pages. $2.10. Mic 58-4092

CLOSURE OF FIVE- AND SIX-MEMBERED CARBOCYCLIC RINGS BY NEIGHBORING π-ELECTRON PARTICIPATION: A KINETIC, CHEMICAL AND THERMODYNAMIC STUDY

(Publication No. 25,275)

Carol Kilbourne Sauers, Ph.D.
University of Illinois, 1957

Several ω-aryl-substituted butyl and pentyl primary alcohols were synthesized by Friedel-Crafts succinoylation and glutarylation of the appropriately substituted benzenes followed by successive reductions with zinc-hydrochloric acid and lithium aluminum hydride. The secondary alcohols, 6-phenyl-hexan-2-ol and 6-(p-anisyl) hexan-2-ol were obtained by sodium borohydride reduction of the corresponding methyl ketones (synthesized by the action of methyl lithium on the appropriate carboxylic acids).

The primary and secondary alcohols were converted to the corresponding tosylate esters and the rates of solvolysis of these esters in anhydrous formic acid were investigated. Selected relative rates of formolysis at 85° in the presence of sodium formate are listed below:

A. Rates relative to 4-phenylbutyl tosylate as 1

$C_6H_5(CH_2)_4OT_s$	(I)	1
p-$MeOC_6H_4(CH_2)_4OT_s$	(II)	2.38

B. Rates relative to 5-phenylpentyl tosylate as 1

$CH_3(CH_2)_5OT_s$	(III)	0.99
$C_6H_5(CH_2)_5OT_s$	(IV)	1.00
p-$MEOC_6H_4(CH_2)_5OT_s$	(V)	0.98
2,4-$(MeO)_2C_6H_3(CH_2)_5OT_s$	(VI)	1.23

The reaction of V with formic acid produced only the corresponding formate while VI gave a small yield of cyclized product, 2,4-dimethoxyhomotetralin, as well as the expected formate. Others have shown that much higher yields of substituted tetralins are obtained from the formolysis of the brosylates corresponding to II.

The results of the product and kinetic studies show that neighboring-group participation of the aromatic ring to form a spiro phenonium ion proceeds to a large extent when the intermediate ring being formed is five-membered and only to a small extent (or not at all) when the ring being formed is six-membered. Thermodynamic calculations predict a reverse relationship if the transition states for the reactions are similar to the cyclic intermediate phenonium ions. The kinetic and product study data are explained by loose transition states for the cyclizations, similar to those postulated for bimolecular substitution. These results are discussed in relation to the mechanisms of aromatic substitution.

Kinetic and product studies of the formolyses of citronellyl tosylate (VII), 6-methylhept-5-enyl tosylate (VIII) and 7-methyl-oct-6-enyl tosylates (IX) were made. Neighboring group participation of the double bonds in these compounds were indicated by enhanced rates of solvolysis of these esters compared to suitable model compounds. Relative rates are listed below.

C. Rates relative to n-hexyl tosylate as 1.

$CH_3(CH_2)_5OT_s$	(III)	1
$(CH_3)_2CH(CH_2)_3CH(CH_3)(CH_2)_2OT_s$		0.76
$(CH_3)_2C=CH(CH_2)_2CH(CH_3)(CH_2)_2OT_s$	(VII)	2.81
$(CH_3)_2C=CH(CH_2)_5OT_s$	(IX)	3.7
$(CH_3)_2C=CH(CH_2)_4OT_s$	(VIII)	44

Cyclic products (olefins and tertiary alcohols) were obtained from VII and VIII upon formolysis while no cyclic products could be isolated from formolysis of IX. These studies were complicated by the addition of formic acid to the double bonds under the conditions of the formolyses.

123 pages. $2.00. Mic 58-4093

I. THE RELATIVE RATES OF THE SIDE-CHAIN ETHYLATION OF AROMATIC HYDROCARBONS. II. POTASSIUM CATALYZED REACTIONS OF ARYLALKANES. III. SODIUM AND POTASSIUM ALKOXIDES AS CATALYSTS FOR CARBANION REACTIONS OF HYDROCARBONS.

(Publication No. 24,922)

Luke Anthony Schaap, Ph.D.
Northwestern University, 1957

Part I

The base-catalyzed reaction of arylalkanes with ethylene yields products in which the benzylic hydrogens are replaced by ethyl groups. The relative rates of various arylalkanes towards this reaction were determined by reacting equimolar mixtures of two aromatics with a small amount of ethylene at 185 ± 4° using a sodium-anthracene catalyst and analyzing for the relative amount of ethylated product from each aromatic. Dialkylbenzenes possessing two different alkyl groups were also reacted to determine which alkyl group was preferentially alkylated.

The carbanion mechanism which has been proposed for this reaction involves the metalation of the α-carbon of the arylalkane followed by the addition of this benzylic carbanion to ethylene. In the following chain propagation step the primary carbanion formed reacts with another molecule of the arylalkane to yield the product and another benzylic carbanion. Either the metalation step or the addition to the olefin can be rate controlling. The order of relative rates is: ethylbenzene > cumene > n-propylbenzene > toluene > s-butylbenzene indicating that the order

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of ease of metalation is not followed except in extreme cases.

p-Dialkylbenzenes react much slower than toluene, and the relative rates vary with higher alkyl substitution as might be expected from an inductive effect. A Hammett plot for the rates of these compounds does not give a straight line because the literature σ values do not vary with the order of inductive effect.

Part II

Arylalkanes were reacted with ethylene at 190° using a potassium-anthracene catalyst. The ethylated product from these reactions contained indans as well as the expected alkylbenzenes. Increasing substitution of the α-carbon of the arylalkane reacted resulted in a larger amount of indan in the ethylated product in agreement with the substituent effects reported for many cyclization reactions.

The mechanism of the cyclization reaction is probably an alkylation of the aromatic nucleus by the primary carbanion which is formed when a benzylic carbanion adds to ethylene. Cumene reacted with propylene to form 1,1,3-trimethylindan in addition to 1,1,2-trimethylindan and 2,3-dimethyl-2-phenylbutane indicating that a secondary carbanion can also take part in the cyclization reaction.

The reaction of 3-methyl-3-phenyl-1-chlorobutane with potassium should generate the same primary carbanion as that formed in the reaction of cumene and ethylene. When this reaction was carried out in refluxing cyclohexane, a small yield of 1,1-dimethylindan was produced. The major products, however, were 2,5-dimethyl-2,5-diphenylhexane and ethylene which were formed in a Wurtz-type reaction in which a carbanionic elimination of a molecule of ethylene preceded the condensation. Similarly 3-phenyl-1-chloropropane yielded a small amount of 1,4-diphenylbutane and ethylene when reacted with potassium.

Some diarlyalkanes which react with potassium to form resonance stabalized carbanions underwent elimination reactions similar to those of the chlorides rather than cyclization reactions.

Part III

Carbanion-type reactions of hydrocarbons such as: the dehydrogenation of d-limonene, the double bond isomerization of olefins, and the side-chain alkylation of arylalkanes were attempted using relatively weak bases such as sodium and potassium alkoxides.

It was found that the dehydrogenation of d-limonene proceeded well at 260° when alkoxides prepared from tertiary alcohols were used. The other reactions took place to only a small extent under similar conditions. Potassium t-butoxide decomposes under the conditions used to produce methane, and it is proposed that this is due to the thermal elimination of methide ions from the butoxide. These methide ions may initiate the reactions that take place. 143 pages. $2.00. Mic 58-4094

I. THE SYNTHESIS OF MEDIUM- AND LARGE-RING KETONES VIA THE DIECKMANN CONDENSATION. II. STUDIES ON CYCLIC AMIDES AND DIAMIDES.

(Publication No. 25,276)

Clarence William Schimelpfenig, Jr., Ph.D.
University of Illinois, 1957

Part I

Hitherto utilized methods for the synthesis of medium- and large-ring ketones have been summarized. The Dieckmann reaction has been used for the synthesis of some cyclic ketones of medium and large size. The following compounds were prepared: Cycloheptanone, cyclooctanone, cyclohendecanone, cyclododecanone, cyclotridecanone, cyclotetradecanone, cyclopentadecanone, 1, 9-cyclohexadecanedione, 1, 10-cyclooctadecanedione, 1, 11-cycloeisosanedione, 1, 12-cyclodocosanedione, 1, 13-cyclotetracosanedione, 1, 14-cyclohexacosanedione, 1, 15-cycloöctacosanedione and 1, 16-cyclotriacontanedione. A standardized high-dilution technique was employed; potassium t-butoxide was the catalyst. Preference for closure of small or large rings was exhibited by relative yields of monoketone and diketone produced upon cyclization of the diethyl esters. A comparison of synthetic methods showed that the Dieckmann reaction was the method of choice for the preparation of 1, 13-cyclotetracosanedione, 1, 14-cyclohexacosanedione and 1, 15-cycloöctacosanedione; 1, 10-cyclooctadecanedione was produced in yield comparable to that obtained by cyclization of the dinitrile. Physical properties of the ketones have been compared with those previously reported; infrared spectra of the diketones have been reported.

Part II

A review has been made of the known cyclic peptides, methods of synthesis employed in the preparation of cyclic amides and some methods of structure determination. Several representative lactams and cyclic diamides have been prepared. A proposal for the clarification of nomenclature has been made in which syn lactams are those which possess an acyclic substituent on nitrogen which extended in the same general direction as the carbonyl oxygen; anti lactams possess the opposite conformation. The infrared spectra of secondary lactams and tertiary lactams have been recorded. On the basis of infrared spectra the conformation of the tertiary lactams could not be assigned. However, on the basis of nuclear magnetic resonance studies it has been deduced that 1-methyl-1-aza-2-oxocyclohendecane and 1-methyl-1-aza-2-oxocyclohexadecane exist in both syn and anti conformations in cyclohexane solution.

1,4-Diaza-5,8-dioxocyclooctane was prepared. Its infrared spectrum indicated that at least one of the amide groups exists in the anti conformation. A synthetic attempt, from which cyclic ethylene glutaramide had been expected, resulted in the preparation of a product assumed to have the structure of 2, 3, 5, 6, 7, 8-hexahydro-5-oxoimidazo[1.2-a]pyridine (1,7-diaza-2-oxobicyclo[4.3.0] non-6-ene). The reaction pathway appeared to include preformation of the cyclic nine-membered ring followed by transannular reaction and dehydration. 1,8-Diaza-2,

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9-dioxocyclotetradecane, 1, 8-diaza-9, 14-dioxocyclotetradecane and 1, 8-dimethyl-1, 8-diaza-2, 9-dioxocyclotetradecane exhibited no transannular interaction which could be detected by infrared spectroscopy.

143 pages. $2.00. Mic 58-4095

REACTIONS OF t-BUTYL PEROXIDE WITH GRIGNARD REAGENTS

(Publication No. 24,882)

Leon Simet, Ph.D.
New York University, 1957

Adviser: Professor Robert T. Morrison

The reaction of t-butyl peroxide with Grignard reagents has been studied.

The reaction with n-butylmagnesium bromide yields t-butyl n-butyl ether, t-butyl alcohol, butane, butene, and octane. The yield of t-butyl alcohol exceeds that of the ether by an amount equal to the yields of hydrocarbons. The yield of butane greatly exceeds that of butene, the ratio being 39:11. The presence of a small amount of manganese chloride cause a large increase in the yield of t-butyl alcohol and hydrocarbons, and a decrease in the yield of ether. The presence of phenylmagnesium bromide (which does not itself react with the peroxide) causes a decrease in the combined yield of butane and butene, and an increase in the proportion of butene. The presence of large amounts of magnesium bromide has no effect on the proportions of products.

The reaction with methylmagnesium iodide yields a gas that is all or nearly all methane.

These facts are consistent with the following proposals. t-Butyl peroxide and Grignard reagents react by two competing paths, one ionic (heterolytic) and the other free radical (homolytic). The heterolytic reaction yields equal amounts of mixed ether and t-butyl alcohol. The homolytic reaction yields t-butyl alcohol and hydrocarbons derived from the alkyl group of the Grignard reagent. Both reactions proceed from a complex between peroxide and a Grignard reagent. The heterolytic reaction involves a 1,3-shift of alkyl group from magnesium to oxygen, as has been proposed previously by other workers. The homolytic reaction involves concerted homolysis of the alkylmagnesium and the t-butyl-oxygen bonds, with formation of bromomagnesium t-butoxide, an alkyl radical, and a t-butoxy radical. If the alkyl radical is methyl, it abstracts hydrogen from the solvent to form methane; if it is a higher alkyl radical, it disproportionates and dimerizes. The t-butoxy radical abstracts hydrogen from the solvent to form t-butyl alcohol, which then decomposes a molecule of Grignard reagent yielding alkane.

79 pages. $2.00. Mic 58-4096

BASE-CATALYZED ALLYLIC REARRANGEMENTS AND AN ABNORMAL DISPLACEMENT REACTION IN THE BENZOTHIOPHENE 1,1-DIOXIDE SERIES

(Publication No. 24,926)

James Dudley Spainhour, Ph.D.
Northwestern University, 1957

The rates of reaction with thiourea in absolute methanol at 30° C for the following compounds are reported.

a). 3-Chloromethylbenzothiophene and its 1,1-dioxide
b). 2-Chloromethylbenxothiophene and its 1,1-dioxide
c). 3-Bromomethylbenzothiophene 1,1-dioxide
d). 2-Bromomethylbenzothiophene 1,1-dioxide
e). 2-Methyl-3-chloromethylbenzothiophene 1,1-dioxide

All of the above react normally (Sn2 mechanism) with the exception of the 3-halomethylbenzothiophene 1,1-dioxides, which react abnormally (Sn2' mechanism). The rate of this abnormal reaction is unexpectedly fast in comparison with the other rates studied. The rates, activation energies, and activation entropies for an Sn2 reaction (2-chloromethylbenzothiophene 1,1-dioxide with thiourea) and an Sn2' reaction (3-chloromethylbenzothiophene 1,1-dioxide with thiourea) are found to be essentially identical. The nature of the Sn2' reaction and the possible reasons for its occurrence in this system are discussed.

The rates of solvolysis in absolute methanol at 50° C for the following compounds have been measured.

a). 3-Chloromethylbenzothiophene
b). 2-Chloromethylbenzothiophene
c). 2-Methyl-3-chloromethylbenzothiophene

The ortho methyl group causes a 58.6-fold increase in the rate of solvolysis.

3-Benzoxy-1-benzenesulfonylpropene-1 rearranges to 1-benzoxy-1-benzenesulfonylpropene-1 on treatment with triethylamine in benzene solution. This reaction is analogous to the rearrangement of 3-benzodymethylbenzothiophene 1,1-dioxide to 3-methyl-2-benzoxybenzothiophene 1,1-dioxide which has been observed previously in these laboratories. The following compounds failed to rearrange.

a). 2-Benzoxymethylbenzothiophene 1,1-dioxide
b). 3-Benzoxy-2-methylbenzothiophene 1,1-dioxide
c). 2-Methyl-3-benzoxymethylbenzothiophene 1,1-dioxide

The mechanism of this unique, base-catalyzed, anionotropic rearrangement is discussed.

82 pages. $2.00. Mic 58-4097

I. PREPARATION OF THE PYRIDAL ACETONES AND THE INDUCTIVE EFFECT OF NITROGEN ON THE DEHYDRATION OF THE INTERMEDIATE ALDOLS. II. POLYMERIZATION OF ALPHA DIOLEFINS WITH METAL ALKYL COORDINATION CATALYSTS.

(Publication No. 25,292)

John Kenneth Stille, Ph.D.
University of Illinois, 1957

I. The synthesis of the 2-, 3- and 4- pyridalacetones was carried out by the Knoevenagel condensation of ethyl acetoacetate with the pyridine aldehydes to yield the ethyl 2-(pyridal) acetoacetates. In the case of the 2- and

3-pyridine aldehydes, the intermediate aldols, ethyl 3-hydroxy-3-(2'-pyridyl)-2-acetylproprionate and ethyl 3-hydroxy-3-(3'-pyridyl)-2-acetopropionate, were also isolated. Hydrolysis and carboxyllation of these intermediates gave the corresponding pyridalacetones and the 4-hydroxy-4-(2'-pyridyl)-2-butanone and 4-hydroxy-4-(3'-pyridyl)-2-butanone in the case of the 2- and 3-isomers.

Although the reaction of pinacolone with pyridine-2-aldehyde proceeded normally at room temperature the reaction of acetone with pyridine aldehydes gave the best yields of products at -20°. Pyridine-2-aldehyde and acetone produced only the intermediate aldol, 4-hydroxy-4-(2'-pyridyl)-2-butanone, while pyridine-3-aldehyde and acetone gave a mixture of 4-hydroxy-4-(3'-pyridyl)-2-butanone and 3-pyridalacetone. The reaction of 4-pyridine aldehyde with acetone yielded only the desired 4-pyridalacetone.

The chemical behavior of these aldol condensation products of the three isomeric pyridine aldehydes is explained by the inductive effect of the nitrogen atom in the pyridine ring, since the ease of elimination of water from the intermediate aldols increases as the distance from the carbon atom bearing the hydroxyl group increases.

II. The metal alkyl coordination compound catalyzed polymerization of the non-conjugated diolefins,1,6-heptadiene, 1,5-hexadiene and 2,5-dimethyl-1,5-hexadiene to yield soluble polymers has been described. The diolefin 1,6-heptadiene was prepared by the pyrolysis of 1,7-diacetoxyheptane, and also by the reduction of 1,6-heptadiyne. Preparation of 1,5-hexadiene and 2,5-dimethyl-1,5-hexadiene consisted of coupling allyl chloride and methallyl chloride, respectively, by the use of magnesium.

Polymerization of 1,6-heptadiene gave a soluble polymer with a dilute solution viscosity in benzene of 0.4 whose melting point was 210-230°. A quantitative infrared analysis showed seven per cent unsaturation, and dehydrogenation yielded a polymer which showed aromatic absorption in the infrared and ultraviolet region of the spectrum. On this basis a polymer containing carbocyclic recurring units was postulated.

Polymerization of 1,5-hexadiene gave a polymer with a dilute solution viscosity of 0.23 which was forty per cent soluble in benzene, and had a melting point of 80-85°. A quantitative infrared analysis showed seven per cent unsaturation. A polymer structure containing cyclic recurring units has also been postulated for this polymer.

Polymerization of 2,5-dimethyl-1,5-hexadiene yielded a low molecular weight soluble polymer which melted at 80-85° and had a dilute solution viscosity of 0.1. Since a quantitative infrared analysis showed eight per cent unsaturation, a carbocyclic structure has been postulated. The polymerization of 2-methyl-1-pentene was attempted by using the same polymerization conditions as were successful for the polymerization of 2,5-dimethyl-1,5-hexadiene. The polymer obtained was only a pentamer, thereby indicating that the intermolecular-intramolecular cyclic polymerization process provides the driving force for 1,1-disubstituted diolefins. 131 pages. $2.00. Mic 58-4098

THE REARRANGEMENT OF 1-ARYL-1-PHENYL-2-IODOETHANOLS

(Publication No. 25,295)

Eiichi Tanda, Ph.D.
University of Illinois, 1957

The rearrangements of several 1-aryl(or methyl)-1-phenyl-2-iodoethanols are the subject of the present study. 1,1-Diphenyl-2-iodoethanol was isolated as a crystalline solid. An attempt to isolate pure iodohydrins of this series failed for the other compounds studied. Evidence that iodohydrins had been formed was provided by infrared examination. These iodohydrins in aqueous acetic acid solution reacted with silver acetate to give two isomeric ketones.

$$\text{Ø(R)C(OH)CH2I} + \text{AgOAc} = \text{ØCOCH2R} + \text{ØCH2COR}$$

The rearranged products were analyzed by the use of ultraviolet spectroscopy. The yields of the rearranged products were 30-70% (based on the ethylenes). The structures of the rearranged product -s were confirmed by infrared spectra and by comparison with authentic samples.

The values of the migration ratios of p-anisyl, p-tolyl, p-chlorophenyl and methyl are 40, 8, 0.8 and 0.13, respectively. In the competitive rearrangements between aryl groups some migration ratios of pinacols, aminoalcohols, 2-substituted ethanols and 2-substituted ethylamines have been previously obtained. The migration ratios are plotted against Hammett's sigma constant. From the shape of the curvature, the empirical equation,

$$\log k/ko = A(e^{-b\sigma} - 1)$$

was deduced, where A and b are constants. By an approximate calculation, A and b for pinacol, iodohydrin, aminoalcohol and amine were determined to be 0.415 and 7.64, 0.724 and 4.36, 0.106 and 3.96, 0.121 and 3.41, respectively. The results of the application of these proposed equation show good agreement over a range of sigma constants where results are available.

74 pages. $2.00. Mic 58-4099

I. & II. THE ADDITION OF AMINES AND HETEROCYCLIC ACTIVE METHYLENE COMPOUNDS TO p-BENZOQUINONE DIIMIDES. III. SYNTHESIS OF BENZOQUINOL IMIDE ACETATES; SCOPE AND LIMITATIONS.

(Publication No. 25,306)

Leslie Morton Werbel, Ph.D.
University of Illinois, 1957

PART I.

The structures of the adducts of benzene and p-benzoquinonedibenzenesulfonimide; piperidine and morpholine and p-benzoquinonedibenzimide were shown to be the 2-substituted p-phenylenedibenzenesulfonamide, and benzamides respectively by unequivocal synthesis. The adduct of aniline and p-benzoquinonedibenzimide was shown to be 4-amino-4'-benzamido-N-benzoyldiphenylamine. Methylaniline and dimethylaniline were added to p-benzoquinonedibenzimide, and the monomethyl adduct converted to the

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dimethyl adduct with formaldehyde and formic acid. Active hydrogen determinations indicate the structures of these adducts as well as those of the same amines with p-benzoquinonedibenzenesulfonimide to involve addition on the imide system at the para position of the amines. Pyrrolidine, p-toluidine and p-iodoaniline did not form adducts with p-benzoquinonedibenzimide.

PART II.

Methone, dibenzoylmethane, benzoylacetone and ethyl acetoacetate were added to p-benzoquinonedibenzimide, and the adducts cyclized in acid to the corresponding carbazole and indole derivatives. Ethyl 2-ketonipecotate formed an adduct but it did not undergo cyclization. No isolable adducts were formed with: 3-ethoxalyl-2-pyrrolidone; 1-methyl-2-pyrrolidone; α-picoline; 2-carbethoxy-1-ketoquinolizidine; ethyl cyanoacetate; benzoylacetonitrile; diethyl γ-chloropropylmalonate; 1,3-indanedione; 1-ethyloxindole; ethyl acetopyruvate; isopropylidenemalonate; dehydroacetic acid; 1-methyl-3-N-methylcarboxamido-2-piperidone; 3-carboxamido-1-methyl-2-piperidone; 4-carbethoxy-1-methyl-3-pyrrolidone and 3-carbethoxy-1-methyl-4-piperidone.

Cyclization of 2-acetylacetonyl-p-phenylenedibenzenesulfonamide with sulfuric acid yielded 3-acetyl-5-benzenesulfonamido-2-methylindole. Constant boiling hydrochloric acid led to 3-acetyl-5-benzenesulfonamido-1-benzenesulfonyl-2-methylindole. Methone and dibenzoylmethane were added to p-benzoquinonedibenzenesulfonimide and the adducts cyclized. 3-Ethoxalyl-2-pyrrolidone gave the hydrate of the normal adduct. 4-Carbethoxy-1-methyl-3-piperidone; 2-carbethoxy-tetrahydrothiapyrane-3-one; 4-carbethoxy-1-methyl-3-pyrrolidone; 4-carbomethoxy-3-oxotetrahydrothiophene and 3-acetyl-1-ethyloxindole were added to p-benzoquinonedibenzenesulfonimide. Pure adducts could not be isolated from 2-carbethoxy-1-ketoquinolizidine; 1,3-indanedione; 3-carbethoxy-2-piperidone; 3-carbethoxy-1-methyl-4-piperidone and dehydroacetic acid.

Acid treatment of the adduct of 4-carbethoxy-1-methyl-3-piperidone and the disulfonimide yielded a product believed to be the hydrochloride of 6-benzenefulfonamido-9-benzenesulfonyl-2-methyl-β-carboline. All other cyclization attempts with heterocyclic adducts failed.

Pyrrolidone, succinimide, the sodium salt of succinimide and the potassium salt of phthalimide could not be added to p-benzoquinonedibenzimide. Attempts to add pyrrolidone, caprolactam, N-bromosuccinimide, benzenediazonium chloride and sodio 6-methylpyridone to p-benzoquinonedibenzenesulfonimide yielded no isolable products.

PART III.

Quinol imide acetates were obtained from N-benzoyl, N-p-nitrobenzoyl and N-p-nitrobenzenesulfonylmesidine upon oxidation with lead tetraacetate. The rearranged acetates (3-acetoxy-N-aroylmesidines) were also prepared.

It was shown that 2,4,6-trimethyl-o-quinolbenzenesulfonimide acetate yielded 3-hydroxy-N-benzenesulfonylmesidine upon treatment with sodium hydroxide.

N-(p-Nitrobenzoyl)-p-toluidine; N-(p-nitrobenzenesulfonyl)-o-toluidine; N-p-nitrobenzoyl-2,6-dimethylaniline; N-benzoyl-2,4-dimethylaniline; N-p-nitrobenzoyl-2,4-dimethylaniline; N-p-nitrobenzenesulfonyl-2,4-dimethylaniline and N-benzoyl-2-aminobiphenyl yielded the corresponding rearranged acetates upon oxidation in acetic acid. In chloroform only inseparable mixtures were obtained.

N-Benzoyl-p-toluidine; N-acetyl-p-toluidine; N-acetyl-o-toluidine; N-benzoyl-o-toluidine; N-(p-nitrobenzoyl)-o-toluidine; N-benzoyl-2,6-dimethylaniline; N-p-nitrobenzenesulfonyl-2,6-dimethylaniline; N-p-nitrobenzenesulfonyl-4-aminobiphenyl; N-p-nitrobenzoyl-2-aminobiphenyl and N-p-nitrobenzenesulfonyl-2-aminobiphenyl yielded no isolable products.

Oxidation of N-(p-toluenesulfonyl)-p-toluidine and N-(p-nitrobenzenesulfonyl)-p-toluidine yielded the quinol imide acetates and the 2,5-quinones of the starting materials.

The imide acetate from N-p-nitrobenzenesulfonyl-2,4-dimethylaniline which could not be isolated was trapped by in situ addition of hydrogen chloride.

Oxidation of N-benzoyl- and N-p-nitrobenzoyl-4-aminobiphenyl yielded inseparable mixtures of the quinol imide acetates and the rearranged acetates.

An imide acetate was prepared from N-benzenesulfonyl-3-amino-2,4,6-trimethylpyridine.

N-Benzoyl- and N-benzenesulfonyl-2-methyl-5-nitroaniline; N-benzenesulfonyl-p-Cl, NO_2, CN-aniline; N, O-ditosyl-p-aminophenol and acetanilide yielded no isolable products upon lead tetraacetate oxidation.

272 pages. $3.50. Mic 58-4100

CHEMISTRY, PHARMACEUTICAL

PROCAINE ANALOGS HAVING PRESSOR GROUPINGS

(Publication No. 25,324)

Hatif Hammoody Al-Jaleel, Ph.D.
University of Maryland, 1957

Supervisor: F. M. Miller, Ph.D.

Compounds which possess anesthetic and pressor activity are desirable in clinical practice. Compounds of this type assist in localizing the anesthetic agent at the desired site, decreasing its concentration in the blood stream and reducing the danger of toxicity. It therefore has become common practice to use local anesthetic drugs in combination with pressor agents.

In the investigation reported herein, compounds which contain in their structures anesthiophoric and pressor moieties have been prepared. The well known anesthetic drug β-diethylaminoethyl p-aminobenzoate (Procaine) has been modified so as to include in its structure the pressor grouping of the aralkylamine type. In another series the structure of Procaine was modified so as to include the grouping of the well known pressor agent naphazoline (Privine). These compounds are expected to have local anesthetic and possibly also pressor activity.

In the present investigation the following new compounds have been prepared in the form of their hydrochloride salts: phenacylaminoethyl benzoate, phenacylaminoethyl p-methoxybenzoate, phenacylaminoethyl p-nitrobenzoate, and phenacylaminoethyl p-aminobenzoate. The latter could not

be induced to crystallize. The new compound N-(3,4-dihydroxyphenacyl)-aminoethyl benzoate was also prepared in the present investigation and, like the previously reported p-nitrobenzoate ester, was unstable.

The following compounds of the Procaine-naphazoline combination were prepared: β-[2-(1'-naphthylmethyl)-1-imidazol-2-ene]-ethyl benzoate, β-[2-(1'-naphthylmethyl)-1-imidazol-2-ene]-ethyl p-methoxybenzoate and β-[2-(1'-naphthylmethyl)-1-imidazol-2-ene]-ethyl p-aminobanzoate. Their picrates were also prepared.

The latter three compounds are the first reported local anesthetics having the pressor moiety of naphazoline.

45 pages. $2.00. Mic 58-4101

CHEMISTRY, PHYSICAL

A CALORIMETRIC STUDY OF DETERGENT SOLUTIONS

(Publication No. 25,366)

Louis Glen Bailey, Ph.D.
Stanford University, 1957

In order to understand better the general behavior of the micelle, and, in particular, its interaction processes with added materials, calorimetric measurements have been made to determine heats of solubilization of several normal aliphatic alcohols and benzene in solutions of sodium decyl sulfate. The alcohols investigated in this study were n-butanol, n-pentanol, n-hexanol, and n-heptanol. For the purposes of thermodynamic analysis, the process of solubilization has been divided into two separate steps. The steps involve the entry of the additive into aqueous solution, followed by the subsequent interaction of this additive with the micelles.

In addition, partial molal heat capacities of several alcohols solubilized in solutions of 0.4 molal sodium decyl sulfate and 0.4 molal sodium dodecyl sulfate were determined. With sodium decyl sulfate, the alcohols investigated were n-hexanol, n-heptanol, and n-octanol. These three alcohols, plus n-nonanol, were studied in the sodium dodecyl sulfate system.

The design and operation of two semi-micro, isothermal calorimeters used in the evaluation of the heats of solubilization and heat capacities is described in detail.

An introduction to the problem of the interpretation of the data on the basis of the two-phase model for detergent solutions is given (the micelle being considered as a separate phase in aqueous solution). It is shown that the analysis of this system using the two-phase model is quite complex, and that considerably more must be known about the properties of detergent solutions before exact interpretations can be made. 113 pages. $2.00. Mic 58-4102

THE MECHANISM OF THE EXCHANGE OF IODINE WITH ALLYL IODIDE, USING IODINE-131 AND CARBON-14

(Publication No. 25,142)

William P. Cain, Ph.D.
Columbia University, 1957

Previous workers have studied the kinetics of the exchange reaction of allyl iodide and iodine in hexane. They found that the exchange reaction occurred through two independent paths, depending on whether the system was or was not illuminated. In the thermal case, which was studied in the absence of light, it was found that the exchange occurred through molecules of iodine, whereas, in the photochemical case, it was found that atoms of iodine brought about the exchange.

In both the thermal and photochemical cases, two different transition states were proposed for the exchange reaction. One of these two kinetically indistinguishable transition states involves the isomerization of the allyl iodide due to an allylic shift, whereas the other transition state does not involve this isomerization.

The purpose of this work is to determine which transition state is involved in both the thermal and photochemical exchange reactions. This is done by determining the ratio of the rate of exchange of allyl iodide and iodine to the rate of isomerization of allyl iodide 1-C-14 ($CH_2 = CH - C^{14}H_2I$) to allyl iodide-3-C-14 ($C^{14}H_2 = CH - CH_2I$) in the presence of iodine.

The allyl iodide-C-14 is prepared from allyl alcohol-1-C-14 through the intermediate allyl tosylate-C-14. The allyl iodide-C-14 produced in this synthesis contains 88% allyl iodide 1-C-14 and 12% allyl iodide 3-C-14.

The rate of isomerization of allyl iodide-1-C-14 to allyl iodide 3-C-14 is determined by measuring the distribution of carbon-14 activity between the 1 and 3 carbon atoms of allyl iodide after measured times of reaction with iodine.

The rate of exchange is determined by employing standard iodine-131 tracer techniques.

In the thermal exchange, measured in the absence of illumination, it is found that the ratio of the rate of isomerization to the rate of exchange is 0.22 ± 0.05. Therefore, a molecule of allyl iodide 1-C-14 will isomerize to a molecule of allyl iodide-3-C-14 at a rate about one-fifth the rate at which a molecule of allyl iodide exchanges with iodine. From a study of the effects of dielectric constant of the solvent and from a consideration of the rather high entropy of activation, it is believed that the thermal exchange probably occurs through an incipient ion-pair transition state. This incipient ion-pair transition state is most probably a structure intermediate between the four center type structure (I) and the ionic structure $C_3H_5^+I_3^-$.

(I) $CH_2 = CH - CH_2$ (I, I, I)

The photochemical exchange, as determined by previous workers, proceeds through a radical chain mechanism. From our work it is shown that the ratio of the rate of isomerization of allyl iodide to the rate of the step $I.^* + AI \rightarrow I. + AI^*$ is 0.53 ± 0.05. Therefore, isomerization of the allyl iodide carbon skeleton occurs with about the

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same probability as non-isomerization during exchange of iodine atoms with allyl iodide.

70 pages. $2.00. Mic 58-4103

COPPER, NICKEL AND SOME OF THEIR ALLOYS AS CATALYSTS FOR THE HYDROGENATION OF CARBON DIOXIDE

(Publication No. 23,429)

Leland Earl Cratty, Jr., Ph.D.
Brown University, 1957

The relative importance of the electronic versus the geometric properties of transition metals and alloys in determining their catalytic activity has been a subject of considerable study. In general these earlier investigations have been concerned with reactions where only one product could be formed and have tended to emphasize the importance of a single factor in determining catalytic activity.

In the present work additional information has been obtained about the importance of the geometric factor versus the electronic structure factor to catalytic activity by studying the hydrogenation of carbon dioxide catalyzed by a series of copper and/or nickel catalysts. The carbon dioxide-hydrogen reaction can form carbon monoxide and water over a pure copper catalyst or methane and water over a pure nickel catalyst. Reaction velocity measurements over the copper-nickel catalysts at temperatures between 300 and 500° centigrade afforded data on total hydrogenating capacity and catalyst specificity or product distribution.

The lattice parameters of the catalysts used in this work were determined by means of powder x-ray diffraction measurements and the catalysts were found to possess the same lattice structures found in copper, nickel alloys prepared by melting the pure components together. Thermomagnetic curves were determined for the nickel-rich catalysts and they revealed normal Curie temperatures; also paramagnetic susceptibility measurements here made were in accord with others made on this system. The variation in the shape of the thermomagnetic curves with catalyst composition is herein attributed to local order effects.

Pure nickel was found to be an efficient methane producing catalyst with only small amounts of carbon monoxide being formed. Alloying less than four per cent of copper caused both the total amount of carbon dioxide reacting and the fraction of this carbon dioxide which was converted to methane to fall sharply. Alloying additional amounts of copper produced rather small effects on catalyst activity which trended downward so that the pure copper was least active at all temperatures. The fraction of the reacting carbon dioxide that was converted to methane was more sensitive to catalyst composition and no methane was formed above 50 per cent copper. Although the detailed mechanism for the heterogeneous catalytic hydrogenation of carbon dioxide is unknown, the data are consistent with the concept that the initial steps in the hydrogenation included one step in which desorption would give carbon monoxide. The specificity of the catalysts is attributed to the result of competition between the rate of carbon monoxide desorption and the rate of further hydrogenation of still adsorbed carbon monoxide. The specificity or product distribution as measured by the fraction of the reacted carbon dioxide converted to methane fell sharply from pure nickel to 3.7 per cent copper, with additional amounts of copper continuing to suppress the methane until none was formed above 50 per cent copper. This fall was paralleled by a sharp fall in the susceptibility of the catalysts from large values for pure nickel to small values above 33 per cent copper. The methane-forming step in the reaction would thus appear to be controlled by the electronic structure as reflected by the catalyst magnetic susceptibility.

Above 50 per cent copper only carbon monoxide formed and this in decreasing amounts as the lattice parameter increased. Lattice parameter also seems to be a controlling factor in the initial carbon monoxide forming reaction below 50 per cent copper. Here from 10 to 33 per cent copper, carbon monoxide production increases with increasing lattice parameter.

A significant aspect of the present work is the emphasis of the importance of both the electronic factor and the geometric factor in determining the selectivities and activities of metal hydrogenation catalysts.

119 pages. $2.00. Mic 58-4517

ELECTRICAL AND STOICHIOMETRIC PROPERTIES OF METAL OXIDES

(Publication No. 24,153)

Alvin Warren Czanderna, Ph.D.
Purdue University, 1957

Major Professor: Jurgen M. Honig

A magnetically compensated quartz beam microbalance is described which operates on the principle of a normal gas density balance. The details of the construction, operation, calibration, and use of the balance in a vacuum system are cited. The instrument is capable of detecting mass changes to a precision of 5×10^{-8} g and to an accuracy of $\pm 10^{-7}$ g; with proper temperature control, it is stable over long periods of time. The device is very rugged in relation to its sensitivity and can be constructed, maintained, and operated without great experimental skill.

A thermoelectric power and conductivity cell adapted for use in a vacuum line is described. Details of the construction and operation of the cell for making measurements on powdered samples as well as on single crystals are cited.

The vacuum system used to control gas pressures to the thermoelectric power cell and the balance housing is described. The methods of preparation of spectroscopically pure oxygen, nitrogen, and hydrogen used in the system are outlined.

The procedure for preparing spectroscopically pure TiO_2 by dissolving silica-free titanium metal in an ammoniacal solution of 90% H_2O_2 is reported. Common impurities, such as Fe, Mn, Mg, Sn, Ni, Al, and Ag, were quantitatively removed by filtration. Care was taken to avoid contamination with Si, which cannot be removed by this procedure. Upon decomposing the peroxide, titania

gel formed, from which TiO_2 was obtained by heating to 200°C. The sample composition was established by titration of Ti^{3+} ion with ferric ammonium sulfate. X-ray diffraction results showed that samples prepared in this manner were of the anatase structure.

The results of an investigation of the oxygen sorption as a function of pressure for several commercially pure TiO_2 powders in the temperature region of 500-950°C are summarized. The decrease in surface area of these powders due to sintering at the elevated temperatures was measured. The change in composition of several spectroscopically pure TiO_2 samples and of a number of spectroscopically pure TiO_2 samples that were doped with known amounts of barium hydroxide, sodium hydroxide, and titanium fluoride was studied as a function of temperature in high vacuum.

The thermoelectric power and conductivity of a nickel oxide single crystal was measured as a function of oxygen pressure in the temperature region of 500-900°C. Plots of thermoelectric power versus reciprocal temperature and versus the logarithm of the oxygen pressure were roughly linear. These data led to a value of 1.05 eV for the location of the oxygen acceptor levels above the valence band on the energy level diagram.

The variation in composition of praseodymium oxide was determined as a function of temperature at an oxygen pressure of 150 mm Hg., and as a function of oxygen pressure from 0-150 mm Hg. at 890 and 905°C. Several transition regions and stable phases were observed.

Column purified cerium dioxide was heated in vacuum and the mass loss and the corresponding change in stoichiometric was measured as a function of temperature from 150 to 1050°C. An incipient oxygen loss by the sample in high vacuum was encountered at 160°C, but the overall mass loss was small up to temperatures of 1050°C. The sorption of oxygen as a function of pressure was observed to vary in several cyclic treatments carried out between 25 and 485°C. Thermoelectric power and conductivity measurements are reported for this temperature region. It was found that the resistivity decreased by several orders of magnitude with a slight departure of the sample from stoichiometric composition in high vacuum above 160°C. The original resistivity could be restored by exposure to oxygen gas. The unusual thermoelectric power data are interpreted on the assumption that the donors are completely ionized and that the bulk of the material becomes progressively accessible to the charge carriers at the higher temperatures.

197 pages. $2.60. Mic 58-4104

I. ADSORPTION OF COBALT AND BARIUM IONS ON HYDROUS FERRIC OXIDE AT EQUILIBRIUM. II. SEPARATION OF CARRIER-FREE SCANDIUM FROM A CALCIUM TARGET. III. RADIOACTIVITY OF SCANDIUM-43.

(Publication No. 24,100)

Joseph Edward Duval, Ph.D.
The Ohio State University, 1952

I

The adsorption of cobalt and barium ions by hydrous ferric oxide at equilibrium has been studied, using cobalt-60 and barium-133, by radioactive tracer methods. Cobalt-60 was obtained by neutron activation of cobalt-59, and barium-133 was produced by deuteron bombardment of spectroscopically pure cesium chloride.

All adsorption experiments were conducted with a constant chloride ion concentration at constant volume and at room temperature. Samples were prepared which contained 2 ml. of ferric chloride solution of desired strength, and 2 ml. of tracer solution. Varying amounts of triple distilled water and 0.01 N. hydrochloric acid were added to the samples in order to keep the final volume and the chloride ion content constant. The samples were prepared in outside ground weighing bottles, which were stoppered as soon as the samples had been titrated to desired pH values and the adsorption of barium or cobalt ions by hydrous ferric oxide was allowed to reach equilibrium. The adsorption time varied from about 45 to 215 hours, after which the bottles were opened and 5 ml. portions were pipetted from the supernatant liquid. These portions were evaporated to dryness in small dishes, and the activities were measured by means of a mica end-window Geiger-Muller tube and scaler. The amount of tracer adsorbed and the amount not absorbed were calculated from the activity of the 5 ml. of solution.

The procedure used to study the effect of varying quantities of adsorbent was the same as the above for the pH effect, except that the quantities of adsorbent were varied and the pH of the samples was kept constant.

TABLE I

Effect of pH on the Adsorption of Cobalt and Barium by Hydrous Ferric Oxide

COBALT

Fe, 4×10^{-6} gram atom			Fe, 4×10^{-6} gram atom			Fe, 60×10^{-6} gram atom		
pH	y/(1-y)	Per Cent Adsorbed	pH	y/(1-y)	Per Cent Adsorbed	pH	y/(1-y)	Per Cent Adsorbed
5.50	0.05	4.3	6.90	0.18	15.0	5.50	0.07	6.8
5.90	0.06	5.4	7.20	0.31	22.9	6.02	0.10	8.9
6.40	0.11	10.0	7.50	0.99	49.7	6.50	0.26	20.7
7.00	0.23	18.9	7.80	2.18	68.6	6.90	0.91	47.5
7.54	1.20	54.6	8.00	4.38	81.4	7.30	4.00	80.0
			8.30	5.52	84.7	7.62	10.20	91.1
						7.91	30.20	96.8
						8.20	92.20	98.9

Constant Factors: Cobalt, 2.8×10^{-9} gram atoms; Chloride, 2.79×10^{-4} gram atom; Volume, 32.1 ±0.2 ml.

BARIUM

Fe, 4×10^{-6} gram atom			Fe, 20×10^{-6} gram atom			Fe, 60×10^{-6} gram atom		
pH	y/(1-y)	Per Cent Adsorbed	pH	y/(1-y)	Per Cent Adsorbed	pH	y/(1-y)	Per Cent Adsorbed
7.51	0.15	13.2	7.51	0.32	24.0	7.53	1.01	50.1
8.01	0.34	24.8	7.99	1.28	56.1	7.90	2.47	71.1
8.51	0.88	46.8	8.51	3.98	79.9	8.31	6.49	86.7
9.03	1.78	64.0	9.02	12.22	92.5	8.67	16.50	94.3
						9.00	45.56	97.9

Constant Factors: Barium, 1×10^{-9} gram atom or less; Chloride, 2.79×10^{-4} gram atom; Volume, 32,1 ±0.2 ml.

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TABLE II

Effect of Adsorbent Quantity on the Adsorption of Cobalt and Barium

COBALT

pH 6.8			pH 7.5		
Fe (gram atoms x 10^6)	y/(1-y)	Per Cent Adsorbed	Fe (gram atoms x 10^6)	y/(1-y)	Per Cent Adsorbed
4	0.12	10.4	4	0.81	44.7
6	0.17	14.3	6	1.20	54.7
10	0.23	18.9	8	1.48	59.8
20	0.41	27.2	10	1.67	62.6
60	0.91	47.5	20	3.44	77.5
			60	10.24	91.1

Constant Factors: Cobalt, 2.8×10^{-9} gram atom; Chloride, 2.79×10^{-4} gram atom; Volume; 32.0± 0.2 ml.

BARIUM

pH 7.5

Fe (gram atoms x 10^6)	y/(1-y)	Per Cent Adsorbed
4	0.12	10.9
6	0.15	12.7
10	0.21	17.2
20	0.39	27.8
60	0.72	41.8

Constant Factors: Barium, 1×10^{-9} gram atom or less; Chloride, 2.79×10^{-4} gram atom; Volume 32.0±0.1 ml.

Experimental Results and Discussion

The results of the adsorption experiments are shown in Tables I and II. The fraction y/(1-y) is the ratio of the quantity of tracer adsorbed to the quantity not adsorbed, at constant volume. The relation of y/(1-y) to the pH and quantity of adsorbent is shown by the equation,

$$K = \frac{y}{1-y} \times \frac{(H_3O^+)^x}{(\text{Adsorbent})^x} .$$

This equation results from treatment of the adsorption system as a cation exchange system in equilibrium when other ion concentrations, such as chloride, are effectively constant. A plot of log y/(1-y) vs. pH when the quantity of adsorbent is constant, or a plot of log y/(1-y) vs. log (gram atoms of iron) when the pH is constant, produces a straight line in most of the region studied, in accordance with the equation.

It is to be noted that under comparable conditions cobalt ions are absorbed to a greater extent than barium ions, the ratio in some instances being as high as 4:1. This finding is the reverse of the order of adsorption of these ions on a phenolsulfonic acid resin.

According to the simplified mass law equation, the exponents of the hydrogen ion and adsorbent concentrations should be the same. The experimental data do not show this, the average values of the exponent of the hydrogen ion concentration being 1.42 and 0.91 for cobalt and barium, respectively, and those of the exponent of the concentration of adsorbent being 0.84 and 0.70, respectively. The disagreement may be caused by the use of the concentration of iron as the concentration of adsorbent in evaluating the data.

II

A considerable amount of scandium is adsorbed by the filter paper when a solution containing scandium of the order of 10^{-9} gram atom or less is filtered. The effects of a number of variables on the adsorption have been determined, and a procedure for separating scandium carrier-free in quantities of 10^{-9} gram atom or less from a calcium target has been devised.

A number of samples of commercially pure calcium carbonate, each containing 25-50 mg., were bombarded with protons in the Ohio State University cyclotron for one hour periods. The target material was picked out of the holder, covered with triple distilled water in a 50 ml. beaker, dissolved by the addition of 10 drops of concentrated hydrochloric acid, and evaporated to dryness. Solution in hydrochloric acid and evaporation were repeated twice more to insure the removal of radioactive fluorine. A tracer solution was prepared by dissolving the residue, which included scandium and calcium chloride from the target material, in 0.01 N. hydrochloric acid.

Samples were prepared, composed of known amounts of tracer solution, triple distilled water, and hydrochloric acid. These were titrated to desired pH values with 0.1 N. ammonium hydroxide and filtered through Schleicher and Schuell Blue Ribbon filter paper, except for one sample which was filtered through White Ribbon paper. The diameter of the paper was 4.8 cm. or 6 cm., the same size being used throughout an experiment. Each paper was washed before the filtration with boiling triple distilled water and dilute ammonium chloride solution (about 10^{-4} M.) of the same pH as that of the solution to be filtered. The papers were washed with 20 ml. of dilute ammonium chloride solution of the same pH as the samples which had been filtered. The amount of scandium adsorbed by the papers was determined by holding papers and funnels under a mica end-window Geiger-Muller tube and counting, or by removing the scandium from the papers with hot 6 N. hydrochloric acid, evaporating to dryness, and counting.

Experimental Results and Discussion

The effect of pH on the amount of scandium retained by filter paper is shown in Figure 1. The percentage of scandium adsorbed, given by Curves A and B, was calculated from the initial activity of the sample and the amount remaining on the filter paper, as determined by holding papers and funnels under a Geiger tube window and counting. The percentage of scandium adsorbed, indicated by Curve C, was obtained from the initial activity of the sample and the amount removed from the paper with hot 6 N. hydrochloric acid. Correction was made for the adsorption of scandium by glassware. Curve C is the most accurate, and Curves A and B are to be considered preliminary results. Maximum adsorption occurs at about pH 8.5.

Table III shows how the percentage of scandium adsorbed varied with coagulation time, i.e., the time between

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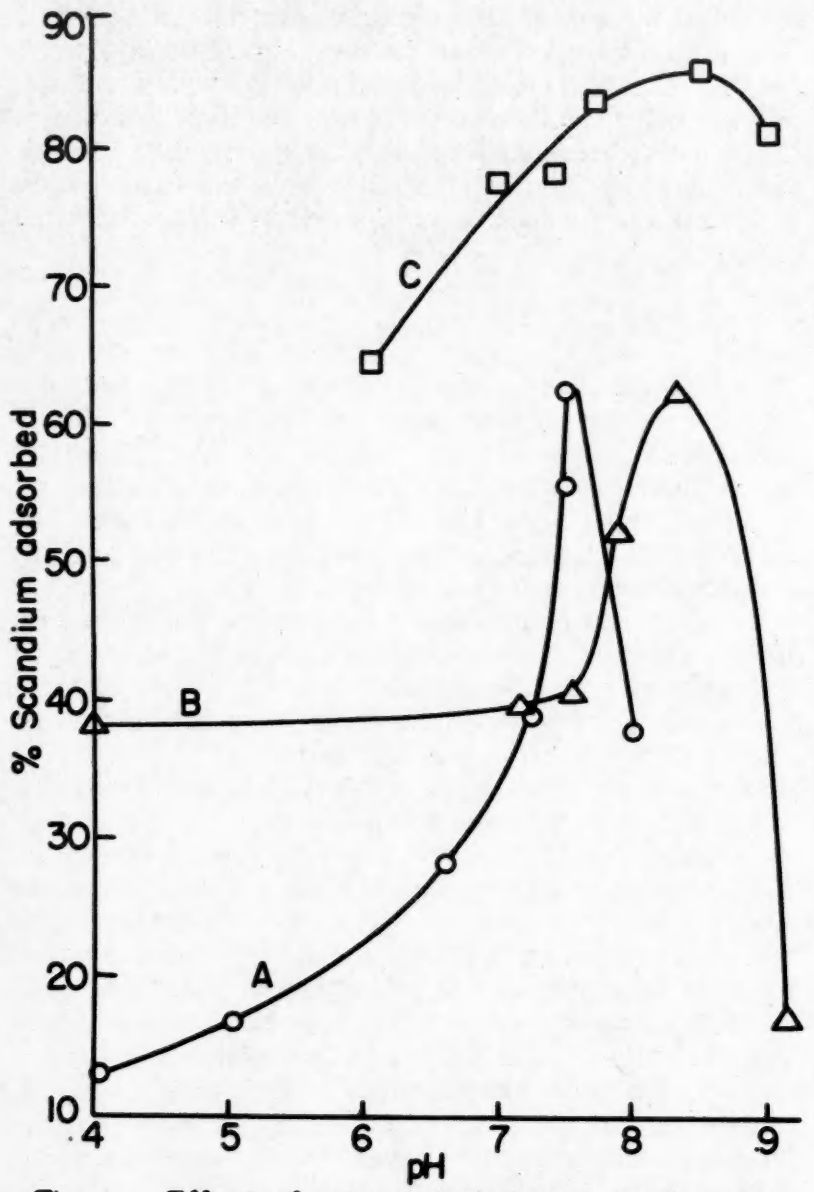


Fig. 1. Effect of pH on Adsorption of Scandium by Filter Paper.

titration and filtration. There is no appreciable difference between the amount adsorbed when the coagulation time was 4.3 hours and when it was 0.1 hour. Table III (B) indicates that if the coagulation time were 24.7 hours, greater adsorption of scandium would occur. A firm conclusion cannot be made, however, since it would be based upon only one comparison. The value, 39.3 per cent appears too low in the light of the other experiments.

TABLE III

Effect of Coagulation Time on Scandium Adsorbed by Filter Paper

A		B	
Coagulation Time (hours)	Per Cent Adsorbed	Coagulation Time (hours)	Per Cent Adsorbed
0.1	67.4	0.1	39.3
4.3	63.5	24.7	77.9

Two samples of pH 7.8 were filtered through 6 cm. papers. One paper was washed with 20 ml. of wash solution and the other with 100 ml. The amounts of scandium retained after the washing were respectively 53.2 per cent and 37.5 per cent, and it is concluded that prolonged washing removes scandium from the paper.

A sample of pH 8.50 was filtered through three 6 cm. filter papers held in funnels one on top of the other, and the papers were washed. The pH of the solution changed during filtration from 8.50 to 8.31. The scandium adhering to the papers was removed with hot 6 N. hydrochloric acid, and after these solutions were evaporated to dryness, the activities were measured. The adsorption by the top, middle, and bottom papers were respectively 69, 21.6, and 4.3 per cent. Corrections have been made for losses on glassware. It is evident that practically all the scandium can be removed in two filtrations.

Three samples which contained tracer in the ratio 1:2:3 were titrated to pH 8.50 and filtered. The amounts of scandium adsorbed, after correction for loss on glassware, were respectively 72.9, 76.3, and 75.7 per cent. There is apparently very little effect caused by the concentration of the scandium within the range studied. This experiment shows also that the tracer solution is of high chemical purity, because if other trivalent ions were present, their interference would result in a noticeable change in the percentage of scandium adsorbed as the concentration of tracer increases.

The influence of ammonium chloride on the adsorption of scandium by filter paper is illustrated in Table IV. The data imply that the presence of ammonium chloride in a tracer solution, which contains the target material and which is prepared with hydrochloric acid, does not have a great effect on the percentage of scandium adsorbed within the range studied.

TABLE IV

Effect of Ammonium Chloride on Adsorption of Scandium By Filter Paper

NH_4Cl (M./L.)	Per Cent of Sc. Adsorbed	NH_4Cl (M./L.)	Per Cent of Sc. Adsorbed
0.003	65.0	0.101	69.4
0.009	72.0	0.168	69.3

One sample of pH 8.50 was filtered through a Schleicher and Schuell White Ribbon filter paper instead of a Blue Ribbon paper. The scandium adsorbed was 25.0 per cent, a markedly lower value than that adsorbed by Blue Ribbon paper. This probably occurs because the White Ribbon paper permits a greater speed of filtration, thus allowing a shorter time for adsorption to take place. The time required for filtration of 25 ml. of distilled water through Blue Ribbon paper is 2.5 times that required for filtration through White Ribbon paper.

The following procedure for carrier-free separation of scandium produced by bombardment of calcium carbonate is proposed:

Cover target material with distilled water in a small beaker and dissolve the material in a minimum amount of hydrochloric acid. Evaporate to dryness and repeat the solution and evaporation twice more to remove radioactive fluorine. Dissolve residue in 25-35 ml. of 0.001-0.01 N. hydrochloric acid and titrate to pH 8.5 with 0.1 N. ammonium hydroxide. Filter the solution through two 6 cm. Schleicher and Schuell Blue Ribbon filter papers in funnels,

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one on top of the other, the pH of the papers having been adjusted previously to 8.5. Wash papers with 20-30 ml. of dilute ammonium chloride solution, the pH of which is 8.5. Remove the scandium from the filter papers separately by treating each with two ml. portions of 3-6 N. hydrochloric acid. The fraction of scandium recovered from the target solution is about 80 per cent, and the time required for separation is 2 hours.

III

The positron and photoelectron spectra of scandium-43 were studied with solenoidal, thick lens, and thin lens spectrometers. Scandium-43 was produced by bombardment in the Ohio State University cyclotron of enriched calcium-43 (72.13 per cent Ca^{43}, 5.17 per cent Ca^{44}) and common calcium (97 per cent Ca^{40}) with about 7 mev. protons and about 20 mev. alpha particles, respectively. Samples were prepared for measurement of positron and conversion electron spectra by carrier-free separation of scandium from the target material in accordance with the method given in Part II, evaporation of the scandium solution to 5-10 drops in a beaker, and evaporation of these to dryness on a 0.55 mg./cm.^{2} rubber hydrochloride film. Samples were made for the study of gamma rays without chemical separation of scandium. The target material itself was loaded in the spectrometer holder.

Experimental Results and Discussion

The radiation from a sample of scandium of thickness less than 0.7 mg./cm.^{2} was studied in a solenoidal spectrometer. The scandium was produced by proton bombardment of enriched calcium-43. The positron spectrum was analyzed, and components with end point energies of 0.76, 1.19, and 1.46 mev. and relative abundances of 16.0, 71.5, and 11.3 per cent, respectively, were identified.

A carrier-free sample of scandium of a thickness less than 0.7 mg./cm^2, which had been obtained by alpha bombardment of common calcium, was mounted in a thick lens spectrometer. The positron spectrum was measured and two components with upper energy limits 0.77 mev. and 1.18 mev. and relative abundances, 24 and 76 per cent, respectively, were found. A third component with an upper energy limit of about 300 kev. appeared to be present in this and the preceding experiment, but positive identification could not be made. The 1.46 mev. component observed previously was not present this time, indicating that it belongs to scandium-44, which was produced by proton bombardment of the 5.17 per cent calcium-44 present in the enriched calcium-43 target.

The log ft values and k-capture to positron ratios were found to be 4.8 and 0.353, respectively, for the 0.77 mev. component and 5.1 and 0.086, respectively, for the 1.18 mev. component. It is concluded that in the decay of scandium-43, 77±7 per cent of the transitions occur with the emission of positrons of 1.18±0.02 mev. upper energy limit, and 23±7 per cent occur with the emission of positrons of 0.77±0.04 mev. upper energy limit. The 77 percent is composed of 71 per cent positrons and 6 per cent k-capture, and the 23 per cent is composed of 17 per cent is composed of 17 per cent positrons and 6 per cent k-capture. The log ft. values are in the range of allowed transitions which obey the selection rules: $\Delta l = 0, 1; \Delta 1 = 0$.

The photoelectron spectrum of scandium produced in a proton bombardment of enriched calcium-43 was observed in a thin lens spectrometer with 21 and 40 mg./cm.^{2} uranium radiators. Gamma rays of 1150, 511, and 375 kev. were found. The 1150 kev. gamma ray is attributed to scandium-44, the 511 kev. component to annihilation radiation, and the 375 kev. component to scandium-43. The energy of the 375 kev. gamma ray was checked with a 17 mg./cm.^{2} lead radiator.

A sample of enriched calcium-44 (91.9 per cent Ca^{44}, 0.3 per cent Ca^{43}) weighing 16.5 mg. was bombarded with protons in order to prove that the 375 kev. gamma ray belonged to scandium-43, not to scandium-44. The target material was loaded in the thin lens spectrometer, and the photoelectron spectrum was obtained with a 21 mg./cm.^{2} uranium radiator. Gamma rays of 1160 and 511 kev. were identified, but none with an energy of 375 kev. The correctness of the assignment of the 375 kev. gamma ray to scandium-43 was proved further by the study of the photoelectron spectrum of scandium produced by an alpha bombardment of common calcium. The most probable product of this reaction is scandium-43, and one of the least probable is scandium-44. Gamma rays with energies of 511 and 375 kev. were found. The activity of the sample was not strong enough to permit a study of the higher energy region of the spectrum.

The K-conversion coefficient of the 375 kev. gamma ray was determined by measuring the photoelectron and conversion electron peaks in the solenoidal spectrometer with the same sample. The scandium, acquired by alpha bombardment of common calcium, was separated from the target material carrier-free, and a sample about 5 mg./cm.^{2} was prepared. A discriminator was employed during the measurement of the conversion electron spectrum to absorb the positrons emitted by the sample. Parts of the positron spectrum were observed to serve as a comparison with data recorded in previous experiments.

The photoelectron peak was measured with the aid of a 21 mg./cm.^{2} lead radiator. The ratio of the area under the conversion electron peak to that under the photoelectron peak was found to be 1.65/6.23, and the K-conversion coefficient was calculated to be 8×10^{-4}. The latter figure was obtained by multiplication of the ratio of areas under the peaks by the factor 3.08×10^{-3}, which had been determined previously by calibration of the instrument with cesium-137.

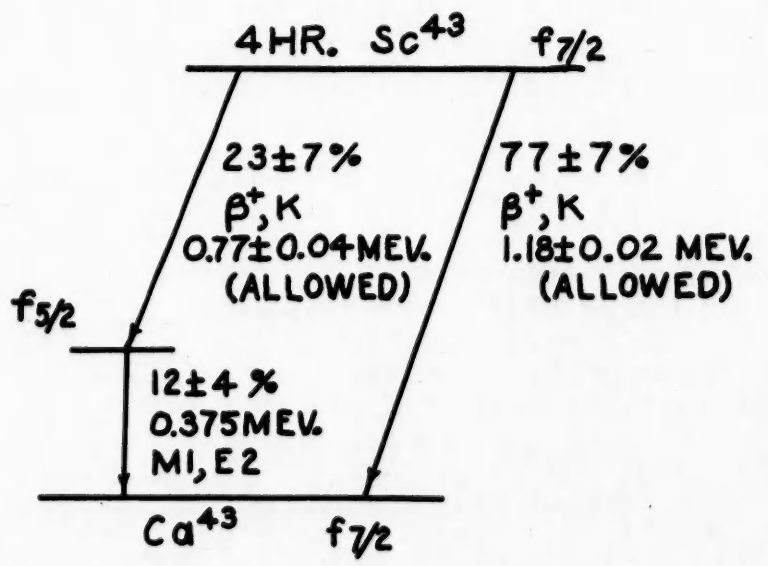


FIG.2. PROPOSED DECAY SCHEME FOR Sc^{43}

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The multipole order of the 375 kev. gamma ray is M 1 or E 2 for this value of the conversion coefficient. The ratio of the number of gamma rays of 375 kev. to the number of positrons emitted in the decay of scandium-43 was calculated to be 0.132.

A proposed decay scheme for scandium-43 is presented in Figure 2. 110 pages. $2.00. Mic 58-4105

Abstract published by special arrangement with The Ohio State University.

A STATISTICAL STUDY OF POLYMER CONFIGURATIONS

(Publication No. 25,215)

Jerome John Erpenbeck, Ph.D.
University of Illinois, 1957

A theoretical study has been made of macromolecular dimensions, taking cognizance of the so-called "excluded volume effect" which invalidates the use of the simple random walk as a model for polymer chains. In lieu of a satisfactory analytic treatment of random walks in which chain intersections are forbidden, a Monte Carlo technique has been employed in conjunction with the University of Illinois digital computer ILLIAC to generate random samples of random walk chains subject to this condition. The average dimensions of these chains (which were necessarily restricted to a lattice) reflect the true average of all possible configurations.

In order to facilitate this study, it was necessary to devise a new generation technique to counteract the attrition in the number of samples obtainable with the number of "steps" taken in the walks. Although earlier numerical work on this problem was limited to chains of 150 steps by this attrition, the new technique has permitted the study of chains of up to 800 bonds.

The dimensions of these chains have been characterized in several ways. The mean square end-to-end distance $\langle r_n^2 \rangle$ of chains has been found to depend upon the number of steps, n, (and, hence, molecular weight) in the following way:

$$\langle r_n^2 \rangle = 1.40 n^{1.18} \quad \text{(3-dimensional tetrahedral lattice)}$$

$$\langle r_n^2 \rangle = 0.800 n^{1.50} \quad \text{(2-dimensional 3-choice square lattice)}$$

These are to be compared with a dependence on the first power of n in the simple random walk theory.

The mean square radius of gyration, $\langle S_n^2 \rangle$, a quantity of particular interest in light scattering theory, has been found to be proportional to $\langle r_n^2 \rangle$ thus:

$$\langle S_n^2 \rangle = 0.157 \langle r_n^2 \rangle \quad \text{(3-dimensions)}$$

$$\langle S_n^2 \rangle = 0.145 \langle r_n^2 \rangle \quad \text{(2-dimensions)}$$

A constant of proportionality of 1/6 was found by the earlier theory.

The mean square distances between elements i and j in an n-step chain, $\langle R_{ij}^2 \rangle$ were found to be given in the 3-dimensional lattice approximately by

$$\langle R_{ij}^2 \rangle = 1.09 \left| \frac{i-j}{n} \right|^{1.13+\nu(i,j)} \langle r_n^2 \rangle$$

with

$$\nu(i,j) = .36 \left| \frac{i-j}{n} \right| \left| 1 - \frac{i+j}{n} \right|$$

Using this expression one may predict the correct constant of proportionality in the above expression for $\langle S_n^2 \rangle$.

A study has also been made on the distribution of end-to-end distances about the mean value found above. Although it is found that the distribution is not Gaussian (as is predicted by simple random walk theory), no new functional form has been suggested. A method for expansion of the data by a set of orthogonal functions (the zero'th order term of which is a Gaussian function) has been developed, but, because the data were limited to 20-step chains, no expression for the expansion coefficients could be suggested.

Also, a partial differential equation has been derived for the correct distribution in two-dimensions, but a solution has not been found. 110 pages. $2.00. Mic 58-4106

THE KINETICS AND MECHANISM OF THE EXCHANGE OF BENZOYL HALIDES AND MOLECULAR HALOGENS

(Publication No. 25,145)

Alex Goldman, Ph.D.
Columbia University, 1955

The kinetics of the exchange reaction between benzoyl iodide and iodine and that between benzoyl bromide and bromine have studied at 0°, 25° and 40°C. for the iodide and at 25° and 40°C. for the bromide. The reaction was followed with the use of I^{131} and Br^{82} as tracers. The kinetics appear to be the same for both halides except that the bromide reacts many times slower than the iodide. The rates can be expressed in terms of a combination of bimolecular and termolecular contributions, the first involving the first power of the halogen concentration and the second the square of the halogen concentration. The reaction is insensitive to light thus excluding a radical mechanism. It is, however, extremely sensitive to moisture, the rate accelerating seceral fold on addition of a trace of moisture. It also increases markedly with increasing dielectric constant of the medium. The rate in ethylene chloride is about sixty times greater than that in hexane. For the iodide, the energy of activation of both the bimolecular (k_1) and termolecular (k_2) rate constants are quite low. They are about 6 and 2.5 Kcal./Mole respectively. The frequency factors are extremely low (about 10^3 Liters/Mole Sec. for k_1 and about 10^2 Liters^2/Mole^2 Sec. for k_2. For the bromide, the energies of activation are higher. They are approximately 17 and 16 Kcal./Mole for k_1 and k_2 respectively. The frequency factors are 10^8 Liters/Mole Sec. for k_1 and 10^6 Liters^2/Mole^{2}Sec. for k_2.

From a consideration of the dielectric constant effects and entropies of activation, the reaction is thought to proceed through a molecular mechanism involving a highly polar transition state. Molecular iodine seems to catalyze the bromide exchange strongly.

119 pages. $2.00. Mic 58-4107

THE HEAT CAPACITY OF SOLID DEUTERIUM FROM 0.3°K AND 13°K

(Publication No. 24,105)

Oscar David Gonzalez, Ph.D.
The Ohio State University, 1951

Introduction

The purpose of the research was to investigate the entropy of mixing in solid deuterium due to the ortho and para forms at the temperatures attainable by liquid helium and at still lower temperatures by the method of magnetic cooling.

The ortho-para distribution in the solid and the entropy effect was discussed for deuterium by Johnston and Long.[1] Their prediction that the behavior of deuterium should parallel that of hydrogen was confirmed by the clorimetric measurements of Clusius and Bartholome,[2] who found a discrepancy in normal deuterium (the ortho-para mixture in the ratio 2:1) between the value of the absolute entropy calculated by statistical methods and the calorimetric entropy derived by the usual application of the Third Law. The discrepancy corresponds to an entropy contribution above the lattice value due to the nuclear spin degeneracy and the degeneracy of the "frozen-in" rotational state J = 1. For normal deuterium the value is given by the expression (1/3 R ln 3 + R ln 9).

In order to investigate the mechanism by which this entropy is removed below 13°K. heat capacity, measurements were carried out on deuterium for the normal mixture, a 97 per cent ortho mixture, and two mixtures of intermediate composition from 1.3°K. to 13°K., and on the normal mixture below 1°K. The research was similar in aim to that carried out for solid hydrogen by Mendelssohn, Ruhemann, and Simon[3] except that it was extended to much lower temperatures.

Apparatus and Procedure

The calorimeter used in the temperature range 1.3°K. to 13°K. consisted of a 35 cc. thin wall copper cylindrical container with its upper lid connected to a monel capillary through which the deuterium was condensed. The calorimeter was suspended from the upper lid of an outer cylindrical monel jacket which was attached by means of a long monel tube to a vacuum system. The tube served to evacuate the annular space between the calorimeter and the jacket, or to introduce helium exchange gas. The capillary passes through a copper block soldered to the pumping tube two inches above the calorimeter and always in contact with the refrigerating bath.

For secondary temperature measurements two independent resistance thermometers of leaded phosphor bronze and constantan wound bifilarly were cemented around the outside wall of the calorimeter. The first, employed in the range 1.3°K. to 4°K., consisted of two specimens of 0.003 in. and 0.005 in. wire wound bare and in series. The second, also bare, was #34 "Advance" wire and was used as a resistance thermometer in the range above 4°K. and as the heater throughout the temperature range. The windings were insulated from the copper wall of the calorimeter by a thin coating of bakelite and from each other by silk thread. The current and potential leads for the thermometers passed through the same copper station as the capillary and through an additional lead block before final attachment.

The phosphor bronze thermometer was calibrated against the vapor pressure of liquid helium during each run. The constantan was calibrated by means of the vapor pressure of liquid and solid hydrogen and by means of a gas thermometer (the empty calorimeter serving for this purpose) between 4°K. and 12°K. The calibration curves were smoothed, and tables of R versus T were prepared for easy conversion of resistance to temperature.

The entire assembly fitted into a two liter helium dewar vessel, which in turn fitted concentrically into a larger liquid nitrogen dewar. The helium dewar was made airtight by means of a standard metal lid and was attached either to a gas return line or to a Kinney vacuum pump for reducing the temperature by adiabatic evaporation.

For the range below 1°K. the calorimeter consisted of 0.15 moles of ferric alum compressed to 95 per cent of its crystalline density around a 3 cc. copper-nickel container into which about 0.1 moles of deuterium were condensed. A cylindrical german silver can concentric with the D_2 container served to hold the salt. A commercial amorphous carbon resistor was firmly embedded in the salt as a resistance thermometer, and a manganin heater was wound around the salt to introduce energy for the heat capacity measurements. The salt and deuterium were cooled below 1°K. by means of the adiabatic demagnetization technique. A liquid nitrogen-cooled solenoid magnet furnishing a maximum field of 5800 gauss were used in this connection. Except for these differences, the apparatus was the same as that used in the liquid helium range.

The lowest temperature attained for the salt and normal deuterium system was 0.3°K. Temperatures below 1°K. were obtained from the extrapolated linear log R versus log T of the carbon resistor calibrated at liquid helium temperatures. Demagnetization of loose ferric alum crystals on which a large proportion of ortho deuterium had been condensed gave the final temperature as that obtained by demagnetization from the same magnetic field on the salt alone. Thus negligible entropy due to the nuclear spin degeneracy is removed down to 0.3°K.

The gas was measured by condensing it from a calibrated five-liter burette, the pressure being measured by a precision manometer. The number of moles was computed from the equation of state of deuterium derived from unpublished data of the Cryogenic Laboratory. The main impurity of the deuterium was 0.16 per cent HD. For the normal deuterium experiments the gas was taken directly from the storage cylinder. The ortho deuterium was obtained by condensation of the gas on a charcoal catalyst for twenty-four hours. The mixtures with intermediate ortho-para ratios were obtained by mixing aliquot portions of normal and ortho deuterium.

White and Wenner potentiometers were used to read the current and voltage of the resistance thermometers, and a Rubicon Type B potentiometer was used for the heater current and voltage measurements. A stop watch was used to measure times.

Results and Discussion

The experimental results are shown graphically in Figures 1 and 2. The data display a deviation of 3 per cent from the smooth curve from 1.3°K. to 13°K. and a deviation of 7 per cent below 1.3°K. The values of the entropy and heat content associated with the anomaly in the normal mixture between -.24°K. and 10°K. are

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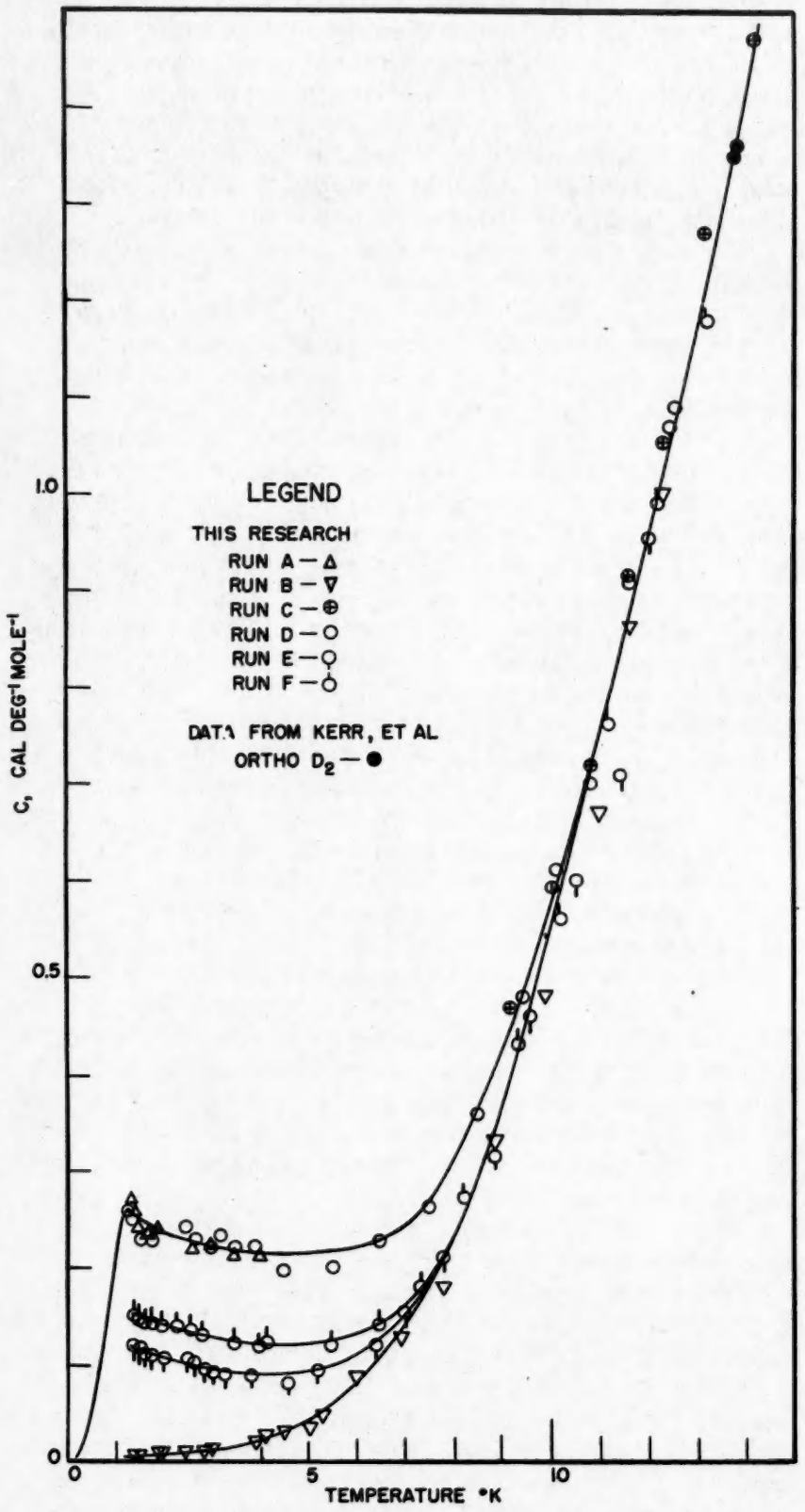


Fig. 1. The molar heat capacity of solid deuterium between 0.3°K. and 13°K. The curve below 1°K. represents the smoothed experimental data. The data of Kerr, et al;[4] was obtained in the Calorimetry division of the Ohio State University Cryogenic Laboratory.

$\Delta S = 0.60 \pm 0.04$ cal./deg/mole of n-D_2 and

$\Delta H = 1.44 \pm 0.04$ cal./mole of n-D_2.

These values were obtained by graphical integration of the heat capacity differences between normal D_2 and ortho D_2 determined from the smooth experimental curves. The difference disappears at 10°K. Below 4°K. the anomalous heat capacity due to the 3 per cent para modification present in the ortho deuterium becomes noticeable, so that the lattice contribution below this temperature was

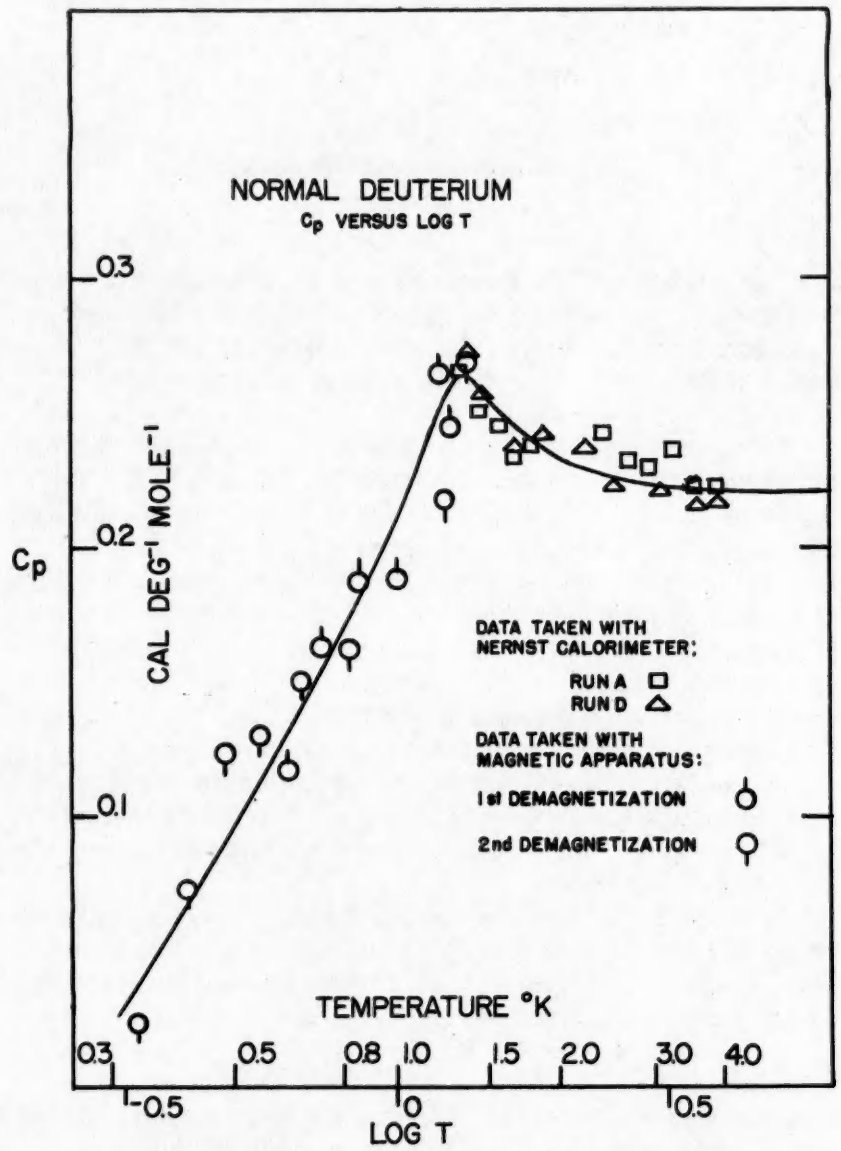


Fig. 2. The heat capacity of normal deuterium below 4°K. The values are plotted against the logarithm of the temperature to emphasize the points below 1°K.

calculated by a Debye equation with $\theta_D = 108°$. The value for θ_D was determined from the data at higher temperatures.

The value of the entropy corresponds most closely with the removal of the rotational degeneracy, which for the normal mixture would give a value 1/3 R ln 3 = 0.73 cal./deg/mole of n-D_2. The difference between this and the experimental value is believed to be due to undetermined residual entropy below 0.24°K. The degeneracy can be removed by a redistribution with temperature of the molecules among the split magnetic levels m = 0 and m = ±1 of the "frozen in" rotational state J = 1. The small value of the heat content is consistent with this mechanism, since the energy associated with the process would be of the order of the level separation, which cannot be greater than the energy difference between the J = 0 and the J = 1 states. By assuming two energy levels, the lowest one corresponding to m = 0 and the higher one to m = ±1 (doubly degenerate), the separation is calculated directly from the heat content to be about 6.5 cal./mole.

92 pages. $2.00. Mic 58-4108

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Abstract published by special arrangement with The Ohio State University.

STUDIES IN MOLECULAR SPECTROSCOPY. MOLECULAR CONSTANTS FROM INFRARED BAND SHAPES. THE ATOMIC DISPLACEMENTS AND INTRAMOLECULAR FORCES IN CF_4 AND THE INFRARED BAND SHAPES AND THE INTENSITIES OF THE INFRARED ACTIVE BANDS OF CF_4. THE C-F BOND DIPOLAR PROPERTIES.

(Publication No. 24,160)

Robert Wesley Hannah, Ph.D.
Purdue University, 1957

Major Professor: Walter F. Edgell

The first order Coriolis coupling constants for the ν_3 and ν_4 bands of CF_4 are obtained from the separation between the maxima of the P and R branches. These are applied to the determination of the atomic displacements in these modes, which, in turn are combined with the vibrational frequencies to give the intramolecular forces.

$$k_r = 6.81 \pm 0.20$$

$$k_{rr} = 0.778 \pm 0.069$$

$$k_\alpha - k_{\alpha\alpha} = 1.030 \pm 0.030$$

$$k_\alpha - k_{\alpha\alpha'} = 0.159 \pm 0.015$$

$$k_{r\alpha} - k'_{r\alpha} = 0.556 \pm 0.045$$

While the accuracy of these values is limited by the accuracy of the Coriolis constants, all ambiguity is removed.

An intensive study has been made of the infrared vibration-rotation bands of CF_4 to verify the theory of Edgell and Gallup that a Beer-Lambert type of behavior should hold for spectrometer tracings of infrared bands provided certain conditions are met in the experimental measurements. This law was found to hold for both bands within the limits of experimental error except in the sharp Q branches where a severe strain is put on the theory. The total integrated absorptions for the two infrared active bands were determined; they are

$$A_3 = 3347 \ \frac{cm^{-1}}{cm.atm.} \ , \quad A_4 = 41.7 \ \frac{cm^{-1}}{cm.atm.}$$

These were used to calculate the C-F bond dipole,

$$u_o = 1.21 \ d \ ,$$

and its derivative with respect to bond length,

$$\frac{\delta u}{\delta r} = 2.66 \ d/A \ .$$

219 pages. $2.85. Mic 58-4109

CARBON ISOTOPE EFFECT STUDIES OF THE DECARBONYLATION OF FORMIC ACID

(Publication No. 25,225)

Rudy Harm Haschemeyer, Ph.D.
University of Illinois, 1957

The C^{13}/C^{12} isotope effect was investigated in two systems: the decarbonylation of formic acid in concentrated sulfuric acid over a temperature range -30° to 0°, and the decarbonylation of pure formic acid at temperatures between 60° and 100°. The experimental isotope effect (expressed as the ratio of the rate constants, k/k', for the C^{12} and the C^{13} formic acid reaction respectively) was calculated from the isotopic ratio of the carbon monoxide resulting from a small extent of reaction and the C^{13}/C^{12} ratio in the original formic acid.

When the data were plotted as 100 ln(k/k') versus 1/T, it was found that, within experimental error, the data from both sets of experiments could be represented by one straight line. This was a strong indication that the rate determining step of the decarbonylation was the same in both systems. For the purpose of theoretical calculations, the experimental data were considered to represent one reaction over the combined temperature range.

Theoretical calculations of the isotope effect by means of a simple bond rupture model were inconsistent with the experimental data. A more sophisticated model of the activated complex was therefore necessary for theoretical interpretation. The normal frequencies for this model, which are necessary for calculation of the isotope effect, were obtained from secular determinants expressed in terms of the F and G matrices. The complete secular equation for determining the vibrational frequencies of formic acid was factored into the appropriate secular equations representing the A' and A" vibrational modes. These were further simplified by the approximate separation of high and low frequencies. Three bending vibrations and the O-H stretching vibration were also neglected since their contribution to the isotope effect is negligible. Appropriate force constants were evaluated by analogy with similar systems or calculated by Gordy's rule.

The isotope effect was calculated for various configurations of the activated complex.

As a result of these calculations, a model for the activated complex was proposed which is in conformity with that postulated on the basis of organic mechanism, and which affords good agreement with the experimental isotope effect.

A critical review of isotope effect theory and a discussion of the application of matrix methods to isotope effect calculations were presented.

116 pages. $2.00. Mic 58-4110

AN ELECTRON DIFFRACTION INVESTIGATION OF THE MOLECULAR STRUCTURE OF CIS-DICHLOROETHYLENE

(Publication No. 24,161)

Charles William Warren Hoffman, Ph.D.
Purdue University, 1957

Major Professor: Robert L. Livingston

A new electron diffraction unit has been completed and put into operation at Purdue University.

The electron wave length is obtained from voltage measurements across a small portion of an accurately known resistance between the cathode of the electron gun and ground. A check on the measurements has been made using zinc oxide powder patterns. The results are in very close agreement.

Operating conditions for gas diffraction patterns have been fairly well established for the use of this instrument. The unit incorporates a rotating sector device to modify the background of the patterns. A check on the instrument was made using carbon tetrachloride and the results obtained were in good agreement with recent investigations in other laboratories. Good patterns of cis-dichloroethylene have been prepared and the structural parameters of this molecule have been deduced with good accuracy. A microphotometer has been employed in order to reduce the subjective nature of the pattern interpretation. Radial distribution calculations supplemented by correlation procedures have been employed in the structural work on cis-dichloroethylene.

Evaluation of all the data led to the following parameters:

$$\text{C-Cl (short)} = 1.722 \pm 0.010 \text{ Å}$$
$$\text{C-Cl (long)} = 2.692 \pm 0.012 \text{ Å}$$
$$\angle \text{ClCC} = 123^{0} \pm 1\tfrac{1}{2}^{0}$$

If planarity is assumed, then the C-C distance would be 1.336 ± 0.016 Å. However, if the molecule is non-planar, then the C-C distance may be appreciably longer than 1.34 Å. Since recent results on ethylene derivatives indicate that the C-C distances do not deviate greatly from 1.34 Å, appreciable non-planarity is unlikely.

89 pages. $2.00. Mic 58-4111

ELECTRODE REACTIONS IN MOLTEN LITHIUM CHLORIDE-POTASSIUM CHLORIDE EUTECTIC

(Publication No. 25,242)

Chui Hsun Liu, Ph.D.
University of Illinois, 1957

The voltammetric microelectrode technique was studied in fused lithium chloride-potassium chloride at 450°C. The stationary microelectrodes were constructed with platinum, tungsten, or graphite, each possessing its own advantageous characteristics. The reference electrode was provided by a platinum foil in equilibrium with a dilute solution of platinum (II). The metal ions studied include cadmium (II), bismuth (III), copper (II), copper (I), zinc (II), thallium (I), indium (III), lead (II), tin (II), gallium (III), mercury (II), mercury (I), and aluminum (III).

Processes involving liquid metal deposition were shown to give rise to limiting current plateaus which were of analytical utility. For solid metal deposition, no well defined plateaus were observed, and the reduction current increased with time near the top of the wave. In the reduction of copper (II) to copper (I), although a flat plateau was observed, it was not reproducible and therefore not analytically accurate. Logarithmic plots were made for the rising portions of the cadmium (II) and bismuth (III) waves; it appeared that the concept of a Nernst diffusion layer might not be applicable under the experimental conditions. The effect of alloy formation at the electrode surface was examined.

The polarographic technique was shown to be a simple and rapid means of establishing the reduction steps of metal ions and obtaining an indication of the reversibility of the electrode process.

In the same sovent medium, electrode potentials were measured for a number of oxidation-reduction systems.

The platinum (II)-platinum (0) system was used as a working reference electrode which could conveniently be prepared by anodic dissolution of platinum with coulometric measurement of the electrolytic equivalents. The potential of this system at one molar platinum (II) concentration was arbitrarily taken as 0.000 volts. To calculate the concentration, the chloride content of the melt compartment was determined argentometrically to evaluate the volume of the melt. The ultimate reference electrode could conveniently be the chlorine-chloride system.

Metal ion-metal couples, including gold, platinum, palladium, mercury, bismuth, antimony, silver, nickel, indium, gallium, copper, cobalt, tin, lead, iron, cadmium, thallium, zinc, aluminum, manganese, magnesium, and lithium in this order of increasing activity were studied, in which the metal ions are in their lowest oxidation states. The metal ions were added as anhydrous chlorides or produced by anodic dissolution of the metal. Nernst equation behavior was checked by measurements at various concentration levels. Standard potentials were obtained by extrapolation to one molar, which was taken as the standard state. Conversion to a molality or a mole fraction concentration scale could readily be made. Most of the values were obtained by conventional potentiometric measurements, the massive metal being used. Some values were established by electrodeposition on a base metal electrode, followed by potentiometric measurements.

The potentials of the copper (II)-copper (I) and the chromium (III)-chromium (II) systems were evaluated by polarographic means, graphite and platinum electrodes respectively being used in the measurements.

These standard potential values were shown to be not only directly applicable to quantitative determinations by the linear relationship between the logarithm of concentration and potential but also extremely useful in providing the basis for other analytical procedures.

76 pages. $2.00. Mic 58-4112

I. STUDIES ON THE EVALUATION OF SEDIMENTATION AND DIFFUSION COEFFICIENTS WITH APPLICATION TO HETEROGENEOUS SYSTEMS. II. THE SURFACE ACTIVITY OF DEXTRAN SOLUTIONS.

(Publication No. 25,266)

Robert Elliott Post, Ph.D.
University of Illinois, 1957

Theoretical considerations of the process of sedimentation in the ultracentrifuge with a sector shaped cell indicate that for at least a limited period of time there will exist a so-called plateau region wherein the concentration is uniform with distance and varies exponentially with time. This variation with time is uniquely determined by the distribution of sedimentation coefficients in the case of a heterogeneous substance. Conversely, the distribution of sedimentation coefficients is uniquely determined by the nature of the variation of concentration with time. There are various possible ways in which the distribution might be evaluated from plateau region concentration data.

It is important to have concentration data for a much longer period of time than is possible with a single sedimentation experiment if the distribution of sedimentation coefficients is to be evaluated, because the concentration vs time function is rather insensitive to small variations in the distribution function. A method is described in which the partition cell can be employed to this end. In this method a sedimentation experiment takes place in several cycles; at the end of each the rotor is stopped and the contents of the cell above the partition are mixed to a uniform concentration. An expression is derived for the concentration as a function of the cumulative total time of sedimentation for the case of equal length cycles and identical times. The cell can be removed from the rotor for the concentration analysis between each cycle. The accuracy of the method is analyzed and the principles of extrapolation of the data to zero concentration are discussed.

The direct measurement of concentration by means of a prism cell is considered and an experimental cell for this purpose is described. With the prism cell light is refracted at a solution-glass interface by an amount depending on the refractive index and hence on the concentration of the solution. This bending is in a direction perpendicular to the usual bending due to the refractive index gradient. A simple adaptation of the schlieren optical system for this purpose is described and a qualitative experimental result using a free boundary diffusion apparatus in an analogous fashion is shown. The method could not be fully tested in the centrifuge because of the lack of special prisms.

A constant gradient method is proposed for the determination of diffusion coefficients using the free boundary technique and the schlieren optical system. In this method the knife edge is set at a fixed height, and the variation with time of the width of the shadow produced in the image of the cell is the basis for the calculation of the diffusion coefficient. Diffraction patterns interfere with the direct measurement of this width, but a formula due to Disteche can be applied to make use of the diffraction fringes themselves. Advantages of the method are chiefly ease of experimental operations and simple calculations. Some data on sucrose are given.

A surface tension apparatus was constructed embodying the principles of the method of Ruyssen and Loos in which the Wilhelmy plate method is modified to permit absolute measurements. Experiments made with this apparatus indicate that the method is a good one capable of yielding precise data.

Solutions of dextran over a large range of molecular weights showed no positive evidence of surface activity. Dextran may actually increase the surface tension as does sucrose, but this could not be confirmed.

132 pages. $2.00. Mic 58-4113

THE MECHANISM AND KINETICS OF THE THIOACETAMIDE HYDROLYSIS REACTION AND PRECIPITATIONS WITH THIOACETAMIDE

(Publication No. 25,153)

Donald Rosenthal, Ph.D.
Columbia University, 1955

The rate of hydrolysis of thioacetamide was found to be first order with respect to thioacetamide in acidic and basic aqueous solutions. The rate in less than 4.5 molar hydrochloric acid solution at 35°C was neither directly proportional to the first power of the hydrogen ion concentration nor to h_o. The observed rates were not significantly different from the rates calculated using the expression: –

$$\log k = \log k_o + \log (H_3O^+) + BC,$$

where k_0 and B are constants whose values were determined for hydrochloric acid hydrolysis, and C is the concentration of hydrochloric acid. This BC term is presumably a specific salt effect upon the activity coefficients involved in the rate expression, i.e. upon

$$f_{CH_3 - \overset{\overset{S}{\parallel}}{C} - NH_2} \times f_{H_3O^+} / f_{M^+}$$

where M^+ is the activated complex. The fact that quite different rates were obtained in perchloric acid solution is consistent with this view.

A mechanism involving the rapid and reversible addition of a proton to thioacetamide followed by the rate determining addition of water is consistent with the observed kinetics. The presence of a protonated thioacetamide ion was detected in solution.

Thioacetic acid was found to be an intermediate in the acid and base catalyzed hydrolysis. The base catalyzed hydrolysis is much more rapid than the acid catalyzed reaction. The hydrolysis is very much slower in the absence of added acid or base.

A maximum was observed in the hydrolysis rate in 4.5 to 5.0 molar hydrochloric or 3.0 to 5.0 molar perchloric acid at 35°C.

A thermistor controlled thermoregulator, and a thermostated spectrophotometer compartment was designed and constructed. This compartment was intended for use at 35-100°C. It was employed for the 35°C kinetic measurements.

Carbon containing precipitates were obtained in the reaction between thioacetamide and cuprous or cupric chloride,

cuprous or cupric bromide or mercuric chloride in acid solution. Silver may also form carbon containing intermediates. The possibility that such carbon containing intermediates are formed in the precipitation of metallic sulfides using thioacetamide was considered.

The nature of the copper-thioacetamide compounds was extensively studied. The empirical formulas for the compounds were found to be C_2H_5NS CuCl, and C_2H_5NS CuBr. The stoichiometry of the precipitation reactions was determined. The copper was found to be present in the cuprous form. The x-ray powder diffraction patterns for these two compounds were satisfactorily indexed assuming hexagonal unit cells. The number of empirical units per unit cell was determined. The conditions of formation, solubility and stability of these compounds were investigated. The infra-red spectra of thioacetamide, the cuprous chloride and cuprous bromide-thioacetamide compounds, and the tetrakisthioacetamide cuprous and argentous chlorides were determined using the potassium bromide pellet technic.

Possible structures were proposed for the cuprous chloride-thioacetamide and cuprous bromide-thioacetamide compounds.

Based on the available evidence it was concluded that these compounds contain thioacetamide in the thion form. The copper of the cuprous chloride is apparently coordinately bound to nitrogen. 129 pages. $2.00. Mic 58-4114

I. DROP DENSITY, WEIGHT, VOLUME AND TIME VARIATIONS DURING CHROMATOGRAPHIC COLUMN DEVELOPMENT. II. AN AUTOMATIC RECORDING DROP-TIME APPARATUS.

(Publication No. 24,794)

Nathan A. Solomon, Ph.D.
New York University, 1955

Adviser: Seymour Z. Lewin

The success achieved by chromatographic analysis in the resolution of extremely complex mixtures makes it one of the most important of modern techniques. Unfortunately, the experimental procedure of elution chromatography is slow and requires constant attention over long periods of time.

Many of the properties of the effluent have been utilized in efforts to devise rational procedures of fraction collection; chief among those which have been more or less successfully employed are refractive index, absorption spectra, fluorescence, dielectric constant, conductance and radioactivity. However, changes in the density, surface tension, viscosity and electrokinetic properties of the effluent during elution have not as yet been capitalized upon.

It was observed in this laboratory that the time-interval between drops issuing from a column varies in an apparently regular way during the chromatographic development and it was considered that this property might be useful as the basis for an automatic fraction-cutting device. The present investigation was undertaken to determine the nature and magnitude of the variations in the properties of the effluent obtained from the column and to design and construct an automatic device to record the changes in the time-interval between drops.

A standard chromatographic column was used. The bottom of the column rested on a fritted glass disc and the effluent flowed through a capillary tube before issuing as droplets from the capillary tip.

The hydrostatic head of the fluid was maintained by means of a constant-level feeding device. The drop-weights, densities and time-intervals between drops issuing from the column were measured.

Three types of systems were studied: a) Dye mixtures adsorbed on alumina and eluted with acetone-water mixtures; b) Cobalt II, copper II and iron III nitrates and chlorides adsorbed on alumina and eluted under a variety of conditions by water and other aqueous media. The elution of cobalt on carborundum was also studied; c) Acetic and propionic acids in water developed by frontal analysis on mixed alumina-charcoal adsorbent and also on a carborundum column.

With the appearance of solute in the effluent, an increase in the time-interval between drops was noted in the alumina and alumina-charcoal systems. At the same time the weights and volumes of the drops decreased while the densities increased. When the drop-time decreased, the weights and volumes increased. On carborundum the drop-time decreased with the appearance of solute.

An analysis of the data indicates that surface tension and viscous flow effects cannot completely account for the observed drop-time changes with alumina columns, although these factors are sufficient to explain the effects with the carborundum columns. This suggests that the factor responsible for the time variations is the streaming potential established between the stationary pore walls and the flowing electrolyte solution. Although specific data for the systems involved are not available, the general effects reported for other systems indicate that zeta potential changes can cause large variations in drop-time interval.

An automatic drop-time apparatus was constructed to record the time-intervals between drops. The general operating principal of the apparatus was the interruption by drops of a beam of light impinging on a photocell. The first impulse activated a wheel to turn and raise an attached weight. A subsequent impulse deactivated the wheel; the attached weight restoring the wheel to its original position. The wheel was connected to a variable resistance which was part of a Wheatstone bridge. As the wheel turned, the current output through the bridge changed. These changes which were indicative of time, were recorded on a Brown Electronik Recorder. The time-intervals of some of the systems described were recorded by this means. 76 pages. $2.00. Mic 58-4115

THE EFFECT OF ADSORBED FILMS UPON THE KINETICS OF ELECTRODE REACTIONS

(Publication No. 25,294)

Wayne Joseph Subcasky, Ph.D.
University of Illinois, 1957

By determining the relationship between the current and the applied potential at the foot of a polarographic wave, the values of the transfer coefficient and the formal heterogeneous rate constant for a totally irreversible electrode reaction can be measured. This method was

used to study the effect of the adsorption of surface active substances, such as camphor, n-octyl alcohol and β-naphthol, upon the reduction of hexaquo nickel (II) ions, iodate ions in acidic and basic media, various amine complexes of copper(II), ammonia complexes of copper(II) and copper(I), and the chloro complexes of tin(IV) and tin(II).

In the presence of saturated solutions of camphor, n-octyl alcohol, or β-naphthol, the number of electrons involved in the rate determining step for the reduction of hexaquo nickel(II) ions was two. In the absence of these surface active agents, there was only one electron involved in this step. The transfer coefficient was the same in the presence of all three surface active agents, but camphor caused a much greater decrease in the rate constant.

The iodide system in an acid medium was complicated by the fact that iodide ions, the product of the reduction, reacted with excess iodate to form iodine. This iodine was reducible at the mercury electrode and gave rise to a catalytic current. The presence of the catalytic current was indicated by variations in the current density with electrode area and was proved by experiments in which the solution was stirred during electrolysis. The reduction of iodate in a basic medium showed a variation in current density with electrode area only in the presence of camphor. Here the complications arose because of catalysis by some intermediate product in the reduction scheme.

The reduction of the ammonia complexes of copper(II) and copper(I) and the ethylenediamine, propylenediamine, diethylenetriamine and theylenediaminetetraacetate complexes of copper(II) were all rendered irreversible by the presence of camphor. In the reduction of the ammonia complex of copper(II), the addition of the first electron was the rate determining step. However, even at low current density in the presence of camphor the product of the reduction was copper. At the same current density in the absence of camphor, the product was copper(I). This occurred because the reduction of copper(I) was faster at the applied potential than the reduction of copper(II).

The reduction of the simpler amine complexes of copper(II) proceeded by the same mechanism. The reduction of the ethylenediaminetetraacetate complex had a much lower rate constant. This showed the effect of size and charge upon a reduction inhibited by adsorbed films.

No value of the kinetic parameters could be determined for the chloro complexes of tin(IV) in the presence of camphor. The reduction of tin(IV) to tin(II) is irreversible even in the absence of surface active agents. However, this reduction is complicated by the presence of a slow chemical step probably involving the formation of the reducible species. The reduction to tin(II) or tin amalgam was inhibited to a greater extent as the applied potential approached the electrocapillary maximum or the concentration of camphor increased. This effect was due to the adsorbed layer becoming more compact. The final increase in current before the desorption of camphor was due to a mixed process involving the reduction of tin(IV) and hydrogen ions. Metallic tin was not the final reduction product. The reduction of tin(II) was reversible even in the presence of camphor.

168 pages. $2.20. Mic 58-4116

AN INVESTIGATION OF THE DISSOCIATION ENERGIES OF NITROGEN AND CARBON MONOXIDE AND THE IONIZATION OF ARGON WITH REFLECTED SHOCK WAVES

(Publication No. 23,457)

Jan Peter Toennies, Ph.D.
Brown University, 1957

The first part of the work describes the assumptions and approximations necessary for the use of shock waves to measure thermochemical constants. The experiments were carried out with shock waves reflected normally from the end of a shock tube because the available enthalpy is higher than for the incident shock and because the incident and reflected shock velocities are two especially convenient measurements.

Reflected shock velocities have been measured in pure nitrogen, pure carbon monoxide and in pure argon. The results agree well with calculations based on the dissociation energies $D(N_2)$=9.76 e.v. (225 Kcal/mole) and D(CO)=11.1 e.v. (256 Kcal/mole), but not with $D(N_2)$=7.38 e.v. (170 Kcal/mole) and D(CO)=9.14 e.v. (211 Kcal/mole). An acceleration of the reflected shock in nitrogen and carbon monoxide is attributed to vibrational relaxation in the incident shock. In argon a pronounced deviation from theoretical reflected shock velocities is attributed to energy and momentum losses to the walls of the shock tube. A method for making allowance for these losses is suggested and applied to the results in argon. Although some deviations from ideal behavior due to energy and momentum losses are shown to be present in the diatomic gases, the results indicate that equilibrium is very nearly attained and that shock tube measurements can provide useful thermodynamic information.

In the second part some preliminary experiments on the rate of ionization of argon in reflected shock waves. are described. The continuum emission from these shock waves has been attributed to the recombination of the ions and electrons. By measuring the continuum emission as a function of time through the reflected shock wave information on the ionization processes was obtained.

The observed times for ionization are longer than those reported by Petschek and Byron for the incident shock. There is also an indication of a very rapid initial ionization process occurring in the reflected shock front which has not been observed in the incident shock wave.

196 pages. $2.55. Mic 58-4117

THE PARTIAL MOLAL VOLUMES OF POTASSIUM IODIDE AND OF IODINE IN ETHANOL AT 25° FROM DENSITY DATA OBTAINED WITH A POISED MAGNETIC FLOAT METHOD

(Publication No. 25,301)

Toshio Tsuzuki, Ph.D.
University of Illinois, 1957

A submerged-float density apparatus was designed and constructed for the purpose of determining the relative densities of ethanol solutions of potassium iodide and of

iodine to a precision of about one part per million. The float contains a sealed-in magnet and is caused to float at a pre-selected vertical position in a liquid when the buoyant force is counterbalanced by the magnetic force produced by current flowing through a tapered solenoid. The novelty of the present apparatus lies chiefly in the fact that the float comes to an equilibrium position.

As a test for the accuracy of the method the densities of aqueous solutions of potassium chloride in the range up to 3% concentration were determined and were found to compare closely to the best literature data. It was observed, however, that in the very low concentration range the densities determined by the float method were significantly greater than those determined by the pycnometer method.

The densities of ethanol solutions of potassium iodide up to 0.1 molal concentration were determined at 25° C. It was found that the apparent molal volume ϕ of potassium iodide in ethanol, within the concentration region studied, could be best represented by the equation

$$\phi = 25.59 + 18.9 \sqrt{m} \text{ in cc./mole}$$

where m is the molal concentration of potassium iodide. From this equation the partial molal volume $\overline{V}$ of potassium iodide in ethanol is given by

$$\overline{V} = 25.59 + 28.4 \sqrt{m}$$

The densities of ethanol solutions of iodine up to 0.1 molal concentration were determined at 25° and it was found that the apparent molal volume of iodine within this concentration region was practically constant at 59.71 cc./mole.

The densities of ethanol solutions of potassium iodide and iodine, in which the concentration of one was varied while the concentration of the other solute was kept essentially constant at about 0.03 molal, were determined at 25° C. When the partial molal volume of the first solute, for which the concentration was varied, was plotted against the mole ratio of the two solutes, an S-shaped curve with its point of inflection at a mole ratio of unit was obtained. The partial molal volume of potassium iodide changed from 17.81 cc./mole at the mole ratio of 0.7 to 31.58 cc./mole at the mole ratio of 1.3. The partial molal volume of iodine changed from 49.41 cc./mole at the mole ratio of 0.6 to 58.61 cc./mole at the mole ratio of 1.7. This fact supports the concept that the complex KI_3 is present in the ethanol solutions of potassium iodide and iodine.

80 pages. $2.00. Mic 58-4118

THERMODYNAMICS OF THE COPOLYMER SYSTEM POLY(ETHYLENE TEREPHTHALATE-SEBACATE)

(Publication No. 24,937)

Bernhard Wunderlich, Ph.D.
Northwestern University, 1957

This thesis deals with the discussion of the thermodynamics and statistics of the copolymer system poly(ethylene terephthalate-sebacate) and is based upon the calorimetric measurement of the specific heat of 2 copolymers with the mole fraction of terephthalate 0.8 and 0.6 and the two homopolymers. Measurements were made between -40° and 300°C with an adiabatic type calorimeter described fully elsewhere. The method of operation of the instrument was improved by separating in favorable cases the non adiabatic drifts of the calorimeter temperature from the heat effects due to supercooled polymers crystallizing to thermodynamically more stable states. Tables of specific heat, enthalpy and crystallinity are given for the 80/20 and 60/40 copolymer as well as for the homopolymer poly(ethylene sebacate). Each of these polymers was measured both in a quenched and annealed state in order to have reproducible starting materials.

The annealed samples are compared with the theoretically accessible case of equilibrium crystallization of FLORY. The specific heat curves have a similar appearance as the theoretically calculated curves. Distinct differences were pointed out. For the quenched samples which crystallize at low temperature a statistical theory has been developed which fits the results obtained from the 80/20 copolymer well. Quantitative discussions of the specific heats, and glass transition temperatures as a function of the composition gave some interesting results.

Additivity of the specific heat of the copolymer could only be realized by means of an empirical increment. All non additivity seems to be introduced by the sebacate repeating units.

For the increase in C_p during the glass transition evidence is given in support of the view that ΔC_{pg} at the glass transition is a function of the area of end interfaces of the crystals.

The glass transition temperature of the low temperature crystallized material is lower than that of the completely amorphous copolymer while the glass transition temperature of the material crystallized under equilibrium condition is higher. These two observations suggest that sebacate repeating units form the crystal ends in the equilibrium case and that the ends are randomly either sebacate or terephthalate units in the low temperature case.

In conclusion it can be said that there are two limiting theories of crystallization of copolymers possible. One, developed by FLORY, assumes equilibrium conditions throughout the crystallization process. The other, starting with a completely random mixture supercooled below the glass transition, allows on warming up only nearest neighbors to crystallize, yielding a completely different crystallite distribution. The real crystals will always be intermediate between the two limits. Annealed materials approximate the FLORY case, but in the special case of the 80/20 poly(ethylene terephthalate-sebacate) it is easier to realize the case of low temperature crystallization. Contradictory results in the literature about the behavior of crystallites with different distributions could be resolved on the basis of these two theories.

The difference between the eutectic point calculated from the thermodynamic data and that determined from direct X-ray measurements (0.06 to 0.30 mole fraction of terephthalate repeating unit) has been explained on the basis of a heat of mixing which occurs when pure terephthalate crystals melt into an amorphous region containing both terephthalate and sebacate units.

147 pages. $2.00. Mic 58-4119

THE CRYSTAL STRUCTURE OF HYDROGEN CHLORIDE MONOHYDRATE

(Publication No. 23,460)

Young Ku Yoon, Ph.D.
Brown University, 1957

The crystal structure of hydrogen chloride monohydrate, $HCl \cdot H_2O$, has been determined at about -35 C. by X-ray diffraction techniques. The crystals are rhombohedral with cell dimensions a = 4.05 Å and $\alpha = 73^0\ 30'$. The space group is R3m.

Each oxygen atom has three hydrogen atoms at the bonding distance arranged in a pyramidal configuration, to form the hydronium ion. The hydronium ion is strongly hydrogen bonded to three neighboring chlorine atoms. The oxygen and chlorine atoms bound by the hydrogen bonds form an infinite two-dimensional net work perpendicular to the [111] axis of the crystal. This layer is not quite planar due to the hydronium ions being out of the plane of chlorine ions. Hence each layer consists of two species of sub-layers, those of OH_3^+ and Cl^- ions. The crystal is formed by packing the layers side by side. Only the van der Waals forces act between the layers and no hydrogen bond is involved.

The symmetry of the crystal structure and the indication that hydrogen atoms are arranged in three-fold positions around each oxygen atom leads to the conclusion that the monohydrate exists in the solid as hydronium chloride. The present investigation confirms the infrared study of the monohydrates of halogen halides.

94 pages. $2.00. Mic 58-4120

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

ECONOMICS, GENERAL

COMPULSORY CONCILIATION AND COLLECTIVE BARGAINING: THE NEW BRUNSWICK EXPERIENCE

(Publication No. 23,430)

William Bannerman Cunningham, Ph.D.
Brown University, 1957

There are several forms of government intervention in labour-management disputes. Canadian dispute-settlement policy is characterized by a compulsory suspension of work stoppages until government-appointed conciliators have attempted to bring about a peaceful settlement. Government assistance is provided in the form of conciliation officers and conciliation boards. If unable to settle a dispute directly conciliation boards must investigate the issues in dispute and recommend terms of settlement in a report to the Minister of Labour. The recommendations are not binding on the parties.

In 1907 Canada enacted the Industrial Disputes Investigation Act. This Act marked the beginning of compulsory conciliation in the form of tripartite boards of conciliation. At first, government intervention was limited to disputes in mines and public utilities but, following a successful challenge of the constitutionality of the Act in 1925 and during the Second World War, the principle of compulsory conciliation was extended to include disputes in most industries. Major changes introduced in 1944 have been continued in the post-war years.

An objective of government policy is the development of collective bargaining. In this study it is assumed that collective bargaining is the most desirable method for determining the terms and conditions of work. A suspension of work stoppages and the compulsory intervention of third parties influence the behaviour and attitudes of the negotiators and thereby alter the collective bargaining process. To evaluate the effects of the compulsory procedures on the negotiating of collective agreements is the objective of this study.

An investigation was made of the experience in the province of New Brunswick. The files at the Provincial Department of Labour were examined for each dispute which required the intervention of government conciliators during the post-war period, 1947 to 1956. This major source of information was supplemented by personal interviews with participants in the compulsory procedures.

Conciliation officers were able to bring the parties to an agreement in 56 of 146 disputes (38.4%). Conciliation boards directly settled 12 of 67 disputes (17.9%) and of the remainder, board recommendations formed the basis of 18 collective agreements. The statistics understated the usefulness of the officers and overstated the influence of the boards in settling the disputes. Violations of the Labour Relations Act were few and court prosecutions non-existent. Consent rather than compulsion, and persuasion rather than prosecution, characterized the administration of the Act.

Effects on collective bargaining were varied. The suspension of work stoppages during conciliation removed a pressure on the parties to make concessions; and the foreknowledge that negotiations could lead to a conciliation officer, then to a board and finally to a board's recommendations reduced the willingness to offer concessions at earlier stages of negotiations. Conciliation commonly consumed several months and conciliation boards were the main cause of delay. The passage of time often altered the relative bargaining power of the parties.

Two major changes are recommended. Government intervention can be compulsory even though work stoppages are not suspended. Adverse effects on collective bargaining mainly resulted from the restrictions on the use of economic pressures. Such restrictions, if retained, should be applied only to disputes of major public importance. Secondly, conciliation boards were not sufficiently successful to offset their harmful effects. In addition to causing undue delays the boards reduced the effectiveness of the conciliation officers. Making the second compulsory stage entirely voluntary would be an improvement. Compulsory intervention of conciliation officers is desirable and should be continued. 238 pages. $3.10. Mic 58-4121

TYPES OF ARBITRATION TRIBUNALS: AN INVESTIGATION OF THEIR COMPARATIVE ROLES IN THE SETTLEMENT OF DISPUTES AT THE PLANT-LOCAL UNION LEVEL

(Publication No. 25,116)

Sister Mary Jordan Dahm, O.S.F., Ph.D.
St. Louis University, 1957

In this study of types of arbitration tribunals an investigation is made of reasons for the selection of a permanent or ad hoc form of tribunal and of results accruing from the continued use of one of these forms. Purposively, the study is concerned with testing the claims of differences in techniques and patterns of reasoning frequently made for the casual and permanent forms of tribunals. The arbitration experience of thirty-seven plant-local union relationships during the period 1945-1954 supplies the empirical basis for the study's findings. For each of these relationships, three sources of data are analyzed: arbitration awards, questionnaire responses, and labor agreements in effect in 1954.

Comparative analysis of the two forms of tribunals reveals more pronounced differences respecting background factors and contractual framework than concerning patterns of dispute settlement. In the first of these areas, differences observed in reasons given for the selection of a tribunal, advantages and disadvantages of the system chosen, and factors considered in the appointment of an arbiter are justified by a single explanation--the desire of the parties to fashion a tribunal suited to their particular needs

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

That the parties are in agreement on what they expect of the arbitration process is evident from their common recognition of the arbiter's function as being judicial in nature. Those variances noted between the two systems respecting the contractual provisions for the use of arbitration in reality merely constitute differing measures of control adopted because of their suitability to particular circumstances.

The analysis of arbitrated grievances is limited to cases arising in three major dispute areas: direction of the working force, discipline and discharge, and job classification and wage rate questions. Variances in the awards of arbiters regarding the settlement of like grievances under each of these headings are few in comparison with the marked uniformity evident in their thinking respecting most issues. The more usual explanation for these observed differences may be found, not in the permanency of the tribunal, but in the stress placed by the arbiter on the rights of management or the importance of maintaining good industrial relations.

An overview of the arbitration experience of a more select segment of the sample results in like findings. A pattern of concentration of arbitration cases in one major grievance area is common to most situations regardless of the form of tribunal established. A pattern of recurrence of like issues, by its infrequency, impliedly reveals that past awards carry considerable weight whether these have been handed down by an individual serving in a permanent or an ad hoc capacity.

On the basis of these findings, several conclusions are drawn. First, the plants in the study are basically interested in achieving like results from their arbitration tribunal. Second, with the more widespread use of grievance arbitration, a body of principles is coming to the fore which is enjoying general applicability. Third, because of these developments, the tenure of the arbitrator, as far as formal arbitration procedures are concerned, does not seem to exercise the pronounced influence frequently attributed to it. 250 pages. $3.25. Mic 58-4122

COMPETITIVE BIDDING STRATEGIES

(Publication No. 24,805)

Lawrence Friedman, Ph.D.
Case Institute of Technology, 1957

Competitive bidding is formulated as a problem in decision theory which can be analyzed by game theoretic methods. The meaning of competition is discussed and the interrelationships among competitors defined by introducing a competitive coefficient. Some simple auction and closed bidding problems in which there are two competitors with limited capitals are solved exactly using the minimax principle. Methods of analyzing real bidding problems are given including a paraphrased case study of an actual bidding situation. A general approach to realistic bidding problems is described using the Bayes Theorem of decision theory. The future of competitive bidding in Operations Research is discussed with particular mention of problems yet unsolved. 123 pages. $2.00. Mic 58-4123

THE USE OF RESERVOIR WATER FOR HYDROELECTRIC POWER GENERATION

(Publication No. 25,373)

John Evans Gessford, Ph.D.
Stanford University, 1957

The problem considered is that of scheduling the use of the reservoir water that is available for the generation of electric power in order to minimize the cost of supplying power. The study of the problem is oriented towards discovering the form of the optimal scheduling method (i.e., towards discovering the determining factors and characteristics of the scheduling method that minimizes the expected cost).

The marginal cost viewpoint is taken. The cost of generating hydroelectric energy is assumed to be zero. Electric energy obtained from an alternative source (thermal energy, for example) is assumed to have a positive, non-decreasing marginal cost. A penalty cost, which is incurred when energy is demanded but not supplied, is also recognized.

Three hydroelectric models are studied. Both the case in which the rate of water flow into the reservoir is known, and the case in which it can be viewed as a random variable with a known probability distribution (this distribution may change with time) are considered. In the hydroelectric model in which river flow is taken to be known the demand for power is assumed to be a known function of time. In one of the two models in which river flow is taken to be a random variable it is not explicitly assumed that the demand for electricity is known. In this model the cost of supplying electricity is assumed to be a convex function of the volume of water used for power generation. This convex function may change with time.

In the first two models, in which river flow is considered to be a random variable, time is divided into subintervals. The analyses of these models are concerned with deciding how much water to use for power generation during each subinterval. The form of the decision rule (to be used in deciding on the quantity of water to let out during each subinterval) that will minimize the costs incurred during a finite period of time is determined by these analyses. This result is established by a mathematical induction argument. The form of this optimal decision rule is simple; it has a single parameter. This suggests the possibility of determining the optimal value of this single parameter through either simulation or analysis of the stochastic process that can be set up by assuming a decision rule of this type will be used.

In the third model time is a continuous variable. The analysis centers around a calculus of variations type problem. It is shown that under certain reasonable conditions as much water as possible should be used for power generation at all times. 83 pages. $2.00. Mic 58-4124

DEMAND RELATIONS IN HOUSING

(Publication No. 23,440)

John James Hughes, Jr., Ph.D.
Brown University, 1957

This study attempts to determine the quantitative importance of factors affecting the consumption of housing. The market for housing is local and competitive; local because of the varied costs of transport to employment locations and competitive because of the large number of units in certain broad categories, the high substitutability between the units in each category, and the large number of buyers and sellers. The price of the stock of housing is determined by disposable income, the size of the stock and the interest rate. The possible rate of change of the stock is small and is determined by the price of existing units and construction costs.

It is not possible to distinguish rental from owned quarters by physical characteristics, but tenants are generally younger, less secure in employment and move more often than homeowners, so that these factors outweigh certain gains for homeownership.

Three statistical problems are involved in estimating the demand function parameters: identification, serial correlation, and correlation between the determining variables. The first problem, whether the demand parameters would be obscured by a simultaneous supply relation, was considered not serious because of the small possible rate of change of the stock. The second problem, which would reduce the reliability of the estimates, was met to some extent by using first differences of the observations. The third was met also to some extent by using cross-section material to determine some of the parameter and time series to determine others.

The effect of income, family size and region was determined for the Housing Census of 1940. This information was then used in a conditional regression to get the values of the other demand factors for time series.

The major problems of data were the absence of a satisfactory index of house prices and the distorted information provided during the post-World War II rent control period.

The result showed an absolute price elasticity of about -1. Two-thirds of the income elasticity of .5 derived from the cross-section data can be ascribed to the income of the previous year. Government insurance of home mortgages has a very small influence on housing expenditures. The highest past consumption of housing was not shown to be a significant factor. The analysis should be undertaken using regions as analytical units when rental data by regions become available. 109 pages. $2.00. Mic 58-4125

PROPERTIES, MODELS AND SOLUTIONS OF ELEMENTARY INVENTORY SYSTEMS AND THEIR EXTENSIONS

(Publication No. 24,800)

Eliezer Naddor, Ph.D.
Case Institute of Technology, 1957

Inventory systems (involving the decision problems: when to produce (or order) and/or how much to produce?) in which the costs of surpluses, shortages and setups are subject to control, are defined; and a methodolgy for solving these systems, as extensions of elementary systems, is presented. The properties of inventory systems: input, scheduling period, output, units, costs, are recognized and numerous possible variations of these properties are discussed.

The initial models given represent systems with simple properties. They are used: to establish starting points for further extensions, to illustrate methods for obtaining the total cost equations and their solutions and to establish standards for comparisons with other more complex systems. The extensions of the initial models deal with effects of: balancing surplus, shortage and setup costs, discrete units, input and output patterns, several items, variability of output and lead time. For all extensions solutions are obtained and the results compared. Some numerical illustrations are given.

The effects of deviations from optimal solutions and the effects of use of estimated parameters are discussed and numerical illustrations illuminate the significance of the results obtained.

The case studies presented deal with: (1) the inventorying of materials and (2) the training of new employees. The inventory systems are analyzed in detail using the methods developed earlier.

The work is summarized and concludes with remarks on the use of the work and problems for further research. The bibliography lists books, articles and general surveys pertaining to inventory systems.

102 pages. $2.00. Mic 58-4126

A STUDY OF CONSUMER ACCEPTANCE OF PREPACKAGED PRODUCE AND MEATS

(Publication No. 24,081)

Emiel Wade Owens, Ph.D.
The Ohio State University, 1952

Purpose

To give an analysis of consumer attitudes and reactions, reasons for acceptance and non-acceptance, relative to prepackaged produce and meats.

Scope

The study was limited to the Negro population of the metropolis Columbus, Ohio, during the month of February, 1951.

Method Employed

The survey proper was made by means of personal interviews of Negro families in Columbus. The families, or consuming units as they are referred to technically, were drawn at random from all the Negro families within the city limits. The universe was then defined as all Negro living units within the city limits, excluding hotels, boarding houses, hospitals, etc.

A decision was made to limit the number of interviews that would be made in each of the 18 census tracts making up the universe; the number of family records obtained was proportional to the number of families in each of the tracts.

Error and bias, relative to the responses of the housewives, could be mitigated, though not entirely eliminated. The methods employed to obtain this objective were:

1. The author attempted to design the questionnaires as simply as possible so that they would not give rise to any undue confusion or misunderstanding.
2. The interviewer attempted to explain questions and edit responses so that they would not be contradictory.
3. Special efforts were made to divorce all bias which would tend to slant the answers given by housewives in one direction.

It might be said in summary that the survey was well designed. The selection of families was solely by chance, the questionnaires were well prepared, and all in all, the results obtained should give a fairly accurate view of the varying degrees of consumer acceptance of prepackaged produce and meats in Columbus, Ohio (or the selected universe).

Prepackaged Produce

Of the 340 families interviewed, 63.6 per cent had used prepackaged produce and 36.4 per cent had not. Of the families that composed the 63.6 per cent, 48.2 per cent had used prepackaged fruits and 83.0 per cent had used prepackaged vegetables. Reasons given for not using prepackaged produce were:

1. Prepackaged produce too expensive . . . . . 46.6 per cent
2. Not available at store used . . . . . 30.5 per cent
3. Quality not dependable . . . . . 15.5 per cent
4. Package unit too small . . . . . 5.5 per cent
5. Package unit too large . . . . . 1.2 per cent
6. Other miscellaneous reasons . . . .7 per cent

Of the 63.6 per cent of families who had used prepackaged produce, only 52.6 per cent preferred it over that produce sold in bulk display form. Those who preferred prepackaged produce did so for these reasons:

1. Better quality . . . . . 36.4 per cent
2. More convenient . . . . . 27.6 per cent
3. More sanitary . . . . . 22.3 per cent
4. Less waste . . . . . 11.5 per cent
5. Other miscellaneous reasons . . . 2.2 per cent

Type of Retail Unit Utilized

In purchasing produce different income groups used different types of retail units. On an average, 35.6 per cent of the families interviewed purchased their produce from supermarkets; 35.0 per cent from independent counter groceries; 25.9 per cent from chain counter groceries; and 3.2 per cent from fruit stands. Almost one-half (46.2 per cent) of the families in the high income group purchased their produce from chain stores, while in the medium and low income groups there was an almost even distribution between supermarkets, chain counter groceries, and independent counter groceries.

Of the 161 families who had used prepackaged fruits, a mere 2.3 per cent were dissatisfied with it; in the main, they stated that often the quality was found to be poor. Approximately 3 per cent of the families who had purchased prepackaged vegetables also stated that the quality had been found to be poor.

Size of Containers

Most of the families were satisfied with the present sizes of containers in which produce is packaged. Percentagewise, almost 50 per cent (37.5 and 44.4 per cent, respectively) of the families with eight and nine members expressed their desires for larger packages. An average of 4.2 per cent preferred smaller packages; 2.7 per cent preferred two sizes; 18.4 per cent preferred larger sizes; and 74.7 per cent stated that the present sizes were satisfactory.

Acceptance Relative to Age of Housewife

The degree of acceptance, relative to the age of housewife, varied in accordance with the economic status of the groups interviewed. The greatest degree of acceptance was found within the medium income group less than 35 years of age. In the low income group, housewives over 55 years of age accepted prepackaged produce more readily than any other age group. The greatest degree of acceptance in the high income group was found within the group aged between 35 and 55.

Acceptance Relative to Place of Birth

The study revealed, although not conclusively, that there is some correlation between place of birth and acceptance of prepackaged produce. Percentagewise, those families who preferred produce ranged from 20.3 per cent of the families born in Ohio to .3 per cent of the families born in Mississippi, Louisiana, and Arkansas. Of the 20.3 per cent of acceptance by families reporting Ohio as their birthplace, 72.5 per cent were in the medium income group, 23.2 per cent in the low income group, and 4.3 per cent in the high income group.

Acceptance Relative to Number of Years in Residence in Columbus

After considering the relationship between the acceptance of prepackaged produce and the birthplace of the families interviewed, an effort was made to correlate consumer acceptance with the number of years in residence in Columbus. Percentagewise, of the 52.6 per cent of families who preferred prepackaged produce over produce sold by the bulk display method, the age group which accepted prepackaged produce most readily was that composed of people who had lived in the city from 30 to 34 years. The lowest degree of acceptance was found in those who had lived in the city from 35 to 39 years.

Prepackaged Meats

Of the 340 families interviewed, 62.6 per cent had purchased prepackaged meats and 37.4 per cent had not. Those with from 6 to 12 months' experience with prepackaged meats showed greater acceptance than those with more or less experience. Of the 62.6 per cent of families who had purchased prepackaged meats, only 34.1 per cent preferred it over that sold in bulk form. Reasons given for this preference were:

1. More sanitary . . . . . 29.3 per cent
2. Speeds shopping . . . . . 28.4 per cent

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3. Gives a wider selection . . . . . 22.4 per cent
4. Offers varied prices . . . . . 6.9 per cent
5. Stores more readily . . . . . 6.1 per cent
6. Has better quality . . . . . 5.2 per cent
7. Simplifies waste disposal . . . . . 1.7 per cent

Reasons given for not buying were:

1. Quality not fully dependable . . . . 27.8 per cent
2. Not available at store used . . . . . 22.7 per cent
3. Visibility not adequate to permit wise selection . . . . . 20.7 per cent
4. Too expensive . . . . . 20.1 per cent
5. Package unit too small . . . . . 5.5 per cent
6. Package unit too large . . . . . 1.6 per cent
7. Moisture condensation undesirable . . . . . 1.6 per cent

Initial Inducements

In response to the question "What induced you to first purchase prepackaged meats?" 30 per cent of the families replied, "The appearance of the product"; 28.2 per cent stated, "Convenience"; 13.8 per cent replied, "Saves shopping time"; and 4.2 per cent stated that there were no alternatives.

Advertisement Noted

Prepackaged meat advertising was noticed by only 45.9 per cent of the families interviewed. Of this 45.9 per cent, 24.7 per cent mentioned newspapers; 12.4 per cent had heard advertising over the radio; 6.2 per cent mentioned billboards; and 2.6 per cent mentioned magazines.

Package Material

Approximately 84.0 per cent of the families interviewed stated that the material in which prepackaged meat is packaged was satisfactory. Those who criticized it mentioned such points as "Containers are not sealed well," "Moisture condensation is not desirable," and "The packages are easily damaged."

Relative to the age of the housewife, the greatest degree of acceptance was found in the group aged from 35 to 55. The greatest degree of acceptance relative to place of birth was found within the groups reporting their birthplace as being Ohio. Relative to the number of years residence in Columbus, those families who had lived in Columbus from 25 to 29 years accepted prepackaged meats more readily than any other residence-age group.

Conclusions

The conclusions emphasized in this study were directed toward the general field of advertising prepackaged produce and meats, and not to any specific method of approach.

Probably the most important single group to direct advertising toward would be the non-users, and several facts are readily apparent when one analyzes the reasons given for not using prepackaged produce and meats. The most prevalent reason given for non-use of prepackaged produce was that it is too expensive; for prepackaged meats, that the quality is not fully dependable. Without any doubt, much could be done in the line of consumer education to overcome these ideas in the minds of many non-users.

Advertising directed toward this particular group should certainly emphasize the waste that is eliminated by the use of prepackaged produce and meats, waste which is as high as 6.9 per cent of the retail value of the produce handled, 25 to 33 per cent of the poultry, and 12 to 43 per cent of the meats.

This approach, combined with the reasons given as to why people like prepackaged produce and meats, should prove valuable in appealing to the 36.4 per cent of families who had not used prepackaged produce and the 37.4 per cent who had not tried prepackaged meats.

Since the study indicates that there is a high degree of correlation between acceptance of prepackaged produce and meats and income, emphasis should be directed toward the high and low income groups in the manner indicated above.

The point that more emphasis should be given to the availability of prepackaged produce and meats cannot be overemphasized. The greatest market for prepackaged items is found in the medium and low income groups, who make up 96.2 per cent of the total population. Approximately 35 per cent of the families in the medium income group and 36 per cent of those in the low income group purchase their produce from independent grocery stores, where the merchandise is usually sold in bulk form.

The industry, then, has the job of convincing consumers that buying produce and meat in prepackaged form is the most economical way to purchase it. When that time comes, we can expect a drastic increase in sales volume, but hardly before then. 280 pages. $3.60. Mic 58-4127

Abstract published by special arrangement with The Ohio State University.

CAPACITY UTILIZATION AS A DETERMINANT OF BUSINESS INVESTMENT IN PLANT AND EQUIPMENT

(Publication No. 25,293)

Donald Courtney Streever, Jr., Ph.D.
University of Illinois, 1957

The purpose of this study is to test the hypothesis that new investment in capital goods is fundamentally associated with the extent to which output demanded utilizes existing capacity. Capital requirements in many industries are fixed relative to output by prevailing technology. Since there are cost and market penalities that firms must face when capacity is deficient or excessive in terms of these requirements, investment tends to rise in relation to output when existing capacity is fully utilized, and to fall when it is under utilized. Stable output tends to depress new net investment since available facilities are adequate. If output falls, new investment will decline, and remain low until the excess of capacity that develops is eliminated.

The statistical form of the hypothesis is $I = a + bO_{-1} - cC_{-1}$ where I is plant and equipment expenditures in constant dollars, O_{-1} is output in a previous period, and C_{-1} is capacity at the beginning of the previous period. The hypothesis was tested for the period 1921-55 for five major industrial classifications: manufacturing and mining, electric power utilities, communications, railroads, and commercial and financial. A simple estimating technique was used for the relatively small

proportion of total investment accounted for by other industries. The final relationships provide a basis for estimating total new plant and equipment expenditures from separate industry estimates of output and capacity.

Relatively satisfactory data were available for I and O for each industry (except commercial and financial), and for C for electric power utilities and railroads. Capacity for other industries was derived from estimates of real net investment.

Estimated annual net investment was computed as the difference between real gross investment and real depreciation charges. Depreciation charges were adjusted for price changes by an especially constructed index that takes account of the life distribution of plant and equipment and the original cost of facilities being depreciated.

For manufacturing and mining, annual net investment was converted to index changes in capacity which when chained to a benchmark provided a series on capacity that is directly comparable with the Federal Reserve Board's index of industrial production. For other industries for which capacity data were not available, capital stock series were constructed by chaining annual net investment to appropriate physical asset bases. The stock data were then adjusted to allow for other factors that influence the volume of practical capacity output attainable from the stock.

The hypothesis was stated in terms of the influence of lagged actual output and capacity variables, rather than in terms of expectational variables. The statistical analysis as well as empirical interview studies in this area suggest abstraction from the role of expectations is, in general, appropriate.

For each industry, except commercial and financial, where the data are weakest, estimates of gross investment, provided by the equations were very close to actual investment expenditures in the peacetime years considered. Coefficients of multiple determination for the manufacturing and mining, transportation, and utility groups ranged between 92 and 96 per cent. There were only three minor reversals in sign between total actual and calculated investment for the period since 1920, that is, three years in which the equations incorrectly predicted the direction of the change in actual investment, and only one for the period 1929-55, the years for which the data are most reliable.

The largest deviations between actual and calculated investment appeared in 1928-30 when new investment exceeded levels indicated by the criteria provided by the relationships. These deviations were substantially greater for the utilities, the growth industries, than for manufacturing and mining and railroads, the cyclical industries. This suggests that officials in the latter more consistently adjust investment plans to existing capital requirements, whereas in the former, under special circumstances prevailing at the end of a boom, capacity may be built substantially ahead of demand on the basis of optimistic expectations. The excess capacity created as a result of erroneous forecasts induces sharp reductions in new investment to retard growth of excess capacity.

The principal conclusion drawn from the analysis is one of substantial verification of the hypothesis. Both the hypothesis and conclusion are strongly supported by the interview studies in this area that were reviewed.

161 pages. $2.15. Mic 58-4128

THE SECONDARY BOYCOTT AND THE TAFT-HARTLEY ACT, 1947-1954

(Publication No. 25,296)

Zachary Taylor, Jr., Ph.D.
University of Illinois, 1957

The amended National Labor Relations Act of 1947, commonly referred to as the Taft-Hartley Act of 1947, made fundamental changes in national labor policy. Among other things it declared certain trade union activities unfair and illegal. One of these activities was the secondary boycott, which had been for many years a major source of product market and labor market pressure in the economic struggle between management and organized labor.

Boycotts may be primary or secondary. A primary boycott, e.g. a strike, is one in which the workers strive to influence their employer directly. A secondary boycott is one in which the workers try to influence a supplier or customer directly, or through their employees to put pressure on a struck employer. Secondary boycotts may be factor or consumer boycotts. A factor boycott is an inducement of the secondary parties to refuse to use a product in the course of employment. A consumer boycott is an inducement of the ultimate consumer to refuse to buy the product.

The purpose of this study was to examine and evaluate the status of the secondary boycott under the Taft-Hartley Act from 1947 to 1954. The methodology employed was to examine the issue involved by an analysis of congressional hearings and debate preceding the enactment of the Taft-Hartley Act of 1947, the structure of the Act as finally passed over presidential veto, the decisions of the National Labor Relations Board and the federal courts and finally the evaluations of labor, management and neutral students of labor relations. The sources used were the appropriate government documents including congressional hearings, and debate preceding the enactment of the Taft-Hartley Act of 1947, the structure of the Act as finally passed over presidential veto, the decisions of the National Labor Relations Board and the federal courts and finally the evaluations of labor, management and neutral students of labor relations. The sources used were the appropriate government documents including congressional hearings and reports, federal court reports, various commercial services reporting and evaluating court decisions, reports of government agencies, particularly the National Labor Relations Board and various journals in the field. Primary emphasis was placed on the Board and court findings in order to determine the legal status of secondary activity by organized labor under Taft-Hartley.

Although major interest of this investigation focuses on the period since passage of the Act, it may be noted in passing the secondary boycott has been a factor in industrial conflict since the early 1800's. By 1890 its use was widespread. After 1890 for a period of 40 years its use was severely restricted under court interpretation of anti-trust legislation. In 1932 with the passage of the Norris-LaGuardia Act and subsequently with the passage in 1935 of the Wagner Act the courts moved rapidly in the other direction. By 1945 unions could use the secondary boycott almost without restriction provided they acted in good faith and not fraudulently, violently or in concert with non-labor groups.

The congressional hearings which preceded the passage

of the Taft-Hartley Act reflected a resurgence of management and public pressure for restrictions on secondary boycott activities of unions. Employer documentation of claims of union abuse of the secondary boycott power was elaborate and lengthy. Union argumentation was brief. It was predicated on the belief remedial legislation was unnecessary.

The Taft-Hartley Act as finally passed over presidential veto contained three major providions with reference to the secondary boycott used hence in the sense of a factor boycott. First, it was declared an unfair labor practice and hence illegal (Section 8(b)(4)(A)). Under this section it is an unfair labor practice for a union or its agents to refuse, or induce the employees of any employer to refuse to handle any goods in any manner during the course of employment in order to force an employer or self-employed person to join any labor or employer association; or, an employer or other person to stop using in any manner the goods of another employer; or, to stop doing business with another. It is a factor boycott, rather than a consumer boycott that is illegal.

Secondly, it was provided (Section 10(1)) a newly created office of General Counsel be required to seek injunctive relief against substantiated charges of secondary boycott activity. Third, the Act said the responsibility for determining facts in a secondary boycott case shall rest with the National Labor Relations Board. The courts shall interest themselves solely in determining whether or not the Board acted properly within its authority. This latter provision clearly raises the relative position of the executive branch of the federal government in dealing with a labor management issue and deemphasized the role of the courts.

What has been the impact of these provisions on the relative positions of labor and management? Has the Act effectively removed one of organized labor's cherished economic weapons? The answer is, in general, yes. Has the Act in practice seriously reduced the economic strength of the trade unions? The answer appears to be, no. At least not under the conditions of high level employment which prevailed 1947-1954. Employer concessions show no decline during this period. Union membership continued to grow. It is evident unions had to place much greater reliance for economic strength on the strike. It is not feasible to determine the number of workers who remained unorganized because of the secondary boycott ban. Nor is it possible to estimate how many concessions unions might have won if this economic weapon had been available without restriction. It would seem, however, that in both instances, the effects of the Act have been at most, very moderate. The actions of the NLRB operating under the Act has fulfilled neither the fears of boycott opponents nor the hopes of extreme proponents.

Unions, like other economic institutions, can abuse their economic power. Yhe public interest may be best served if certain activities are restricted. Prior to the 1930's, anti-trust laws were applied to unions. But anti-trust legislation was not successful in reconciling the conflicting aims of restricting certain actions of labor on one hand, and encouraging peaceful bargaining on the other. In contrast the Taft-Hartley Act prohibits secondary boycotts on one hand, but protects and encourages labor's right to organize and bargain collectively on the other.

The Taft-Hartley Act in establishing rules of behavior appears to provide a workable atmosphere for collective bargaining. The Act restricting unilateral union restraints facilitates a free market and technological advance.

Some revisions of the Taft-Hartley secondary boycott proscriptions seem desirable in order to make the Act more effective. Allocation of struck work for the benefit of the employer faced with a strike seems to be unfair to the striking union. Union refusal to handle struck work should be permissible. Interpretation by the NLRB has permitted such refusal under certain conditions. However, the Act should be changed to permit refusal under other conditions as well. Wording of such permission should be carefully limited to that situation where work is transferred from a struck plant for the benefit of the struck employer.

Another area in which union secondary activity would be equitable is that of action against the competition from "sweatshops." This would require wide discretionary power by administrative authority. An alternative would be strengthened social legislation such as the Fair Labor Standards Act which would reduce the need of organized labor to protect itself from "sub-standard" shops.

Although the mandatory injunction has not unduly harmed unions, the use of the injunction should be discretionary on the part of the NLRB. Since there is no comparable provision concerning management practices it is unfair to single out unions for this treatment. Equity requires equal treatment for both sides. Making the injunction discretionary should also reduce the work of the Board and the courts, and make for speedier disposition of cases.

Section 303 which permits civil suits for damages for secondary boycotts should be repealed. The definition of a secondary boycott parallels that in section 8(b)(4)(A), and thus adds nothing. Although infrequently used, there have been attempts at private petition for injunctive relief. In legislation designed to foster peaceful collective bargaining by establishing certain rules of behavior, any section concerned with damage suits by either party is inappropriate.

Management has severely criticized the development of the "hot cargo" clause in labor-management contracts. Secondary boycott activity, with the exceptions noted above, is contrary to the public interest. Likewise forcing an employer to agree beforehand to permit a secondary boycott also should be an unfair labor practice. The most reasonable way to dispose of the "hot cargo" clause is to apply the common law doctrine that contracts for an illegal purpose are unenforceable.

240 pages. $3.10. Mic 58-4129

THE DEVELOPMENT OF MANUFACTURING INDUSTRY IN THE STATE OF WASHINGTON, 1899-1947

(Publication No. 25,397)

William Wolman, Ph.D.
Stanford University, 1957

The purpose of this study, which relies heavily on Census of Manufactures data for its empirical basis, is: (a) to present the historical record of the Washington manufacturing economy insofar as it is available, and

(b) to attempt to account for the rate of growth of the manufacturing economy of the state, its structure, and changes in its structure.

The study utilizes a "model" of regional economic growth applicable to small regions contained in a large free-trade area. The fortunes of such regions are shown to be primarily dependent on the degree of success of those of its industries which sell goods in external markets; those industries which cater primarily to the internal market are shown to be best viewed as passive--their level of activity being determined by the success of the export sector of the regional economy. The export industries developed by a region are shown to be dependent on its locational background which determines the lines along which it will have comparative advantage.

The analysis is then rendered concrete through a presentation of the locational factors influencing Washington's economy. The characteristics of the population, resources, and transportation facilities of the state are discussed. In this way a basis is laid for an understanding of the "events" which have afforded the state opportunities for economic advance and of those which have constrained the ability of the state to respond to these opportunities.

A detailed analysis of the record of the Washington manufacturing economy is then presented. The first concern is with structural questions. The uniqueness of the structure of the state's manufacturing economy is examined. This is followed by an analysis of changes through time in the structure of the state's manufacturing industry.

The growth patterns which have characterized the state's manufacturing economy are then studied. The growth of total manufacturing in the state is compared with that in the nation. Periods of relatively slow and rapid growth in the state's manufacturing economy are identified. The sources of growth and decline in each period are studied and some discussion is presented of the types of events which have been propitious to relatively rapid advance and of the causes of periods of relatively slow growth.

Some possible causes of productivity differentials between regions are presented. The productivity of Washington manufacturing industry is then compared with that of the nation as a whole, both in the aggregate and for the state's major industry groups. An analysis is made of the differences which exist.

The implications of this study for an understanding of future developments in the Washington manufacturing economy are explored.

Appendices contain: (a) the most complete record of the state's manufacturing industry which has heretofore been presented, and (b) a detailed technical account of the methods involved in assembling this record.

297 pages. $3.85. Mic 58-4130

ECONOMICS, AGRICULTURE

CHANGES IN LABOR PRODUCTIVITY IN ILLINOIS AGRICULTURE, 1944 TO 1954

(Publication No. 25,228)

John Herman Herbst, Ph.D.
University of Illinois, 1957

Comparisons were made of residual income to farm operator labor among the twelve economic areas of the state and between the farm operator labor residual and earnings of factory workers in each economic area. The relationship between movement of operators from farms and changes in farm operator labor residual was studied.

Data from the United States Census of Agriculture were used for estimating changes in farm operator labor residual. Earnings of factory workers were estimated from data supplied by the Illinois Department of Labor and the Illinois State Employment Service.

The study centered around two hypotheses: 1) The operator labor resource employed in Illinois agriculture has declined at a sufficiently rapid rate since 1944 to maintain the same relationships between the value product of agricultural operator labor and the value product of factory labor that existed at that time, and 2) Adjustments in the operator labor resource in Illinois agriculture have not been great enough since 1944 to narrow the differences in the value products of agricultural operator labor among areas of the state.

The first hypothesis was rejected on the basis of the sign test, indicating that the value products of farm operator and factory labor had moved farther from optimum labor resource allocation.

A failure to reject the second hypothesis by the F-test indicated that resource allocation of operator labor among areas was not better at the end of the period than at the beginning.

In southern Illinois, Areas 7 and F, 8, and 9 showed improvements, but Areas 10 and 11 declined, as compared with northern and central Illinois areas.

The use of rank correlation showed a closer relationship between percentage changes in number of commercial farms and in the farm operator labor residual (significant at about the 20 percent level) during 1949-54 than for 1944-54 or 1944-49. The relationship between area rankings for absolute level of operator labor residual and changes in number of all farms was significant at about the five percent level, indicating that movement from farms was greatest in areas having a low level of farm operator labor residual, although changing Census definitions of a farm may have had some influence in this respect.

By the use of coefficients of concordance, agreements in rankings of areas in regard to groups of items, including percentage change in number of commercial farms, showed higher degrees of significance during 1949-54 than during 1944-54 or 1944-49. Agreement was significant at the one percent confidence level for percentage changes in: operator labor residual, number of commercial farms (opposite direction), value of machinery and equipment on commercial farms, and total land value per commercial farm.

Since resource allocation had not moved toward the optimum, economic implications for educational and

service agencies suggested that steps be taken to provide more information on off-farm opportunities to farmers and prospective farmers and to encourage low-income farmers to expand operations to a point supplying an "adequate" level of living for the family. A system of selective credit was advocated to afford "easier" credit for those who could expand operations, but to discourage credit extension where this would tend only to perpetuate uneconomical farming operations. More reliance should be placed on "free market" prices to facilitate adjustments in agricultural labor, but it was felt that the "family farm" should be preserved.

Further studies in resource allocation, farm income, migration and occupations, establishment of industry in low-income rural areas, and general agricultural policy were advocated. 197 pages. $2.60. Mic 58-4131

ECONOMICS, COMMERCE - BUSINESS

A STUDY OF THE EFFECT ON FUNDAMENTAL MOTION TIMES OF SUPERIMPOSING VISUAL AND MENTAL TASKS ON A BASIC MOTION PATTERN

(Publication No. 23,709)

Clifton A. Anderson, Ph.D.
The Ohio State University, 1952

The increasing application of the various techniques which employ the idea of predetermined, or fundamental, motion times for the purpose of setting standard times in industrial operations has caused these techniques to be subjected to ever closer scrutiny. Claims that accurate standards can be consistently established by such means are frequently heard. Examination of these techniques reveals that they are essentially based on a system of assigning the predetermined or fundamental motion time values to the series of physical motions which the operator is required to perform in accomplishing the task. Further examination discloses that the hand motions comprise the basic structure for determining the actual time value assigned. Such a procedure is quite appropriate for many operations where the operator is able to develop a high degree of automaticity because the motion pattern always remains the same. There are certain types of work such as sorting and inspection work, however, where there is a continuing demand upon the visual and discriminatory senses.

The dissertation studies these additional requirements in an effort to determine their effect on the time required to perform the work. In the study these requirements assume the form of a visual identification and a mental decision. The null hypothesis which forms the basis of the experiment is stated as follows:

> If the motor task is basic to the proper determination of time necessary to perform a given task, then adding a sensory and discriminatory task to this basic work pattern will not lengthen the time required.

The results of the tests definitely reject this hypothesis for the tasks as they were designed.

The simple motor task which was devised as the basic work requirement consists of sorting forty plain pressed-board circular tokens, or chips, into eight slots arranged in an arc about the dispenser. The forty chips are presented by the left hand from an opening in the dispenser, one at a time, and distributed in sequence to the eight slots from left to right. Four basic movements or therbligs are required to dispose of each chip, viz., grasp chip, move chip to slot, position and release chip, and return to dispenser. Distribution of five chips to each of the eight slots for a total of forty chips completes the task.

The second task employs a similar chip except that each chip bears a marking with India ink. Eight different characters, easily distinguishable and recognizable, corresponding to similar markings on the slots are inscribed on both sides of the chips. Of the forty chips, there are eight sets of five which bear similar markings. These chips are thoroughly mixed and placed in the dispenser in random order. The dispenser is so made that the operator can view the succeeding chip as soon as the one before it is removed. Thus he is able to see the next chip and, while disposing of the previous one, is able to decide to which of the eight slots to direct his next movement. The motor task, the visual task, and the discriminatory task may thus be accomplished almost simultaneously. The order of the movements to the various slots is determined by the random order in which the chips appear in the dispenser. The third task is similar to the second except that a baffle is placed between the operator and the dispenser so that he is not able to see the oncoming chip until after it is grasped. This causes the operator to perform the visual, mental, and motor tasks serially rather than simultaneously.

A statistical analysis of the data reveals highly significant differences between the means of the three tasks when comparing Number 1 with Number 2, Number 1 with Number 3, and Number 2 with Number 3. From practical considerations, Task 2 requires approximately 26 per cent more time than does Task 1. Task 3 requires approximately 78 per cent more time than does Task 1. Thus Task 3 requires nearly 40 per cent more time than does Task 2. All of the tasks were performed at nearly maximum speed by each subject. These differences appear important to anyone interested in accurate rates.

The experiment was conducted in the Motion and Time Study Laboratory at the Pennsylvania State College on a group of 46 industrial engineering students enrolled in a course on motion and time study. A series of practice periods were conducted to enable the subjects to learn the method and memorize the slot locations of the various identifying characters. This served to minimize learning during the actual conduct of the record trials. Efforts were made to standardize the instructions and training so that all subjects were handled as uniformly as possible.

A portion of the experimental trials was recorded on motion picture film. Data from these films were analyzed in detail so that additional variable factors such as the basic motion, slot location, and chip sequence as well as task and subject might be studied. By means of the statistical methodology of the analysis of variance, a study of the relative importance of these variables and their interactions was carried out.

The null hypothesis which was set up for this experiment assumed that superimposing a mental and discriminatory task upon the basic motion pattern would not result in an increase in time required to perform the cycle.

Even under the most favorable circumstances, which were taken to be when the components of the tasks could be performed simultaneously, the time required for the task containing the requirements of visual identification and mental decision was significantly longer. The extent of the increase in time is sufficient to be of practical importance. It is concluded therefore that it is necessary in the interests of attaining at least acceptable accuracy in setting rates utilizing the fundamental motion standard data techniques that recognition be given to the nature of sensory and discriminatory requirements of a job and that suitable time allowances be made for their performance.

Where the work of the eye and the mental processes can be so ordered as to permit a continuing functioning of these faculties, then the speed of the motor movements will accommodate themselves to the former, on a somewhat uniform basis, i.e., all of the elements will be slowed down. Where the sensory and discriminatory elements appear in one part of the cycle, some operators slow all of the elements in adapting to the slower motor pace necessary during the discriminatory portion of the cycle. Other operators are able to change their pace from one part of the cycle to another. The results of the experiment indicate that while the major portion of the change in time may be attributable to the element where the discrimination must be made, all parts of the cycle are affected in terms of time required.

247 pages. $3.20. Mic 58-4132

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CONCEPTS OF DEPRECIATION AND THEIR IMPLICATION IN ACCOUNTING THEORY AND PRACTICE

(Publication No. 25,193)

Phayom Bhavilai, Ph.D.
University of Illinois, 1957

The purpose of this thesis is to develop an appropriate accounting concept of fixed asset depreciation in compliance with the basic accounting postulates underlying present accounting practice. Investigation has been made into various conceptions of fixed asset depreciation which have been referred to or implied in the fields of accounting, economics, law, and engineering. Theoretical analysis and comparison of these conceptions are necessary for development of the depreciation concept which is considered most appropriate for accounting purposes.

This study involves, in the first place, a thorough analysis of the "cost" and "value" concepts of depreciation. Evaluation is extended to the "deferred maintenance" concept under which depreciation of fixed assets is measured by the difference between the present value of fixed property and its replacement cost new. The problem of maintaining capital, which is sometimes understood as one of the primary objectives of depreciation accounting, is also given thorough consideration. Possible accounting treatments for normal and extraordinary obsolescence are evaluated from the theoretical standpoint after considering justifications for the exclusion of "loss" elements from the amount designated as depreciation. The effect of general price level changes is considered insofar as it influences managerial judgment in selecting the depreciation base. In addition, a careful evaluation of the various methods of apportionment is included to facilitate the selection of an appropriate method of apportioning fixed asset cost in view of the concept thus developed.

As a result of this study, the accounting concept of fixed asset depreciation may be summarized as follows:

1. Depreciation is a cost of operations measured in terms of acquisition cost.
2. Current value does not afford an appropriate basis for measuring depreciation.
3. Depreciation is not measured by comparing the present value of property with its replacement cost new as featured by the "deferred maintenance" concept.
4. It is not the primary function of depreciation to provide for the maintenance of capital either in terms of money invested, purchasing power of money invested, physical property, or the operating efficiency of property.
5. Deduction for depreciation as a cost of operations on the basis of historical cost automatically provides for capital maintenance in terms of the money invested in property (assuming that revenues are sufficient to cover all costs, expenses, and losses, including depreciation).
6. Depreciation includes only the cost of those services that are utilized in operations.
7. Those ineffective efforts or losses resulting from the abandonment of usable services are excluded from the amount designated as depreciation.
8. Normal obsolescence is to be provided for as a regularly recurring loss separately from the depreciation allowance.
9. Extraordinary obsolescence is to be recognized as a loss chargeable against net operating income of the period in which it occurs.
10. It is not the function of depreciation to provide for the replacement of fixed assets.
11. Adherence to historical cost is always desirable, even under conditions of changing price levels.
12. Depreciation is not properly determined on the basis of "original cost" (as used in public utility regulation), reproduction cost, replacement cost, or fair value of the property.
13. Depreciation of fixed property does not fluctuate in proportion with revenue earned by the enterprise and cannot be properly determined by revenue.
14. Price level movements do not justify a departure from historical cost as the basis for determining depreciation.
15. The cost of depreciable property is to be apportioned among various periods benefitted on a basis of use as well as on the basis of time.

197 pages. $2.60. Mic 58-4133

THE MANAGERIAL PROBLEMS ENCOUNTERED IN THE OPERATION OF SMALL RETAIL ESTABLISHMENTS IN WESTERN COLORADO

(Publication No. 24,821)

Harold Eudell Binford, Ed.D.
Indiana University, 1957

Chairman: Elvin S. Eyster

The Problem

The problem is a study of difficulties and problems encountered by managers in the operation of small retail establishments located in western Colorado. Answers to these questions were sought as a basis for solving the problem:

1. What is the status of small retail establishments in western Colorado?
2. What are the difficulties and problems encountered by managers of small retail establishments?

Procedure

The data obtained were of two major types: (1) facts and opinions revealing the status of small retail establishments in western Colorado, and (2) difficulties encountered by managers in the operation of such establishments. The first type was obtained through a questionnaire completed by 254 managers of small retail establishments. The second type was obtained through interviews with 50 managers, supplemented by observations of the establishments in operation. From the difficulties encountered, the managerial problems were deduced.

Each of the retail establishments included in the study had the following characteristics: received major income from buying and selling merchandise, had annual gross sales of less than $500,000, was not organized as a chain, and was located in a city of 2,500 or over in the immediate area served by Western State College.

The procedure used to check the adequacy of the data pertaining to difficulties was: interview a sizable number of managers, deduce the problems from the difficulties, and compare the problems with those deduced from data collected in previous interviews. No new problems were revealed when the number of managers interviewed reached 50.

Findings and Conclusions

Problems were encountered by managers from the time the business was in the planning stage until the merchandise purchased was sold and the transaction recorded. The problems of all retail types were closely related, and they fell naturally into the six problem areas of personnel, financial management, physical facilities, distribution, record keeping, and public relations.

Since many problems had persisted with the managers, deficiencies of the manager and/or the business must have existed. Therefore, seven conclusions with respect to these deficiencies were possible: (1) the training for management had been inadequate; (2) the managers were hampered by physical limitations; (3) the managers could do little to solve some problems due to a lack of available aids; (4) the managers appeared to have mistaken ideas of independence and were unwilling to learn or follow sound business practices; (5) the managers were too busy with daily routines of business; (6) the managers were not kept informed of current business practices; and (7) the managers could do little to solve some problems, due to the size of the business.

Implications

Recognizing that it is the responsibility of educational institutions to provide aid in solving the managerial problems encountered in the operation of small retail establishments, administrators and faculty must offer extended present and enlarged future services. Possible aids would be improved syllabi for teaching business management courses, specialized courses concerned with small business management, short training courses for managers, research reports on small business operations, and informational aids presented through pamphlets, bulletins, and charts.

The managers of small retail establishments must be willing to learn and accept new ideas if the improved and extended services of the educational institutions are to benefit such establishments.

196 pages. $2.55. Mic 58-4134

AN APPRAISAL OF DEPARTMENT STORE EXPENSE MANAGEMENT PROBLEMS, CONCEPTS, AND PRACTICES

(Publication No. 24,103)

Charles William Emory, Ph.D.
The Ohio State University, 1951

The growth of interest in marketing has focused attention on the problems of high distribution costs. Basic to an over-all analysis of marketing costs are such important aspects as the selection of marketing channels, determination of functions to be performed and the locus of their performance, analysis and improvement of operational efficiency, and general problems of marketing methods. Among these problems, that of improvement in efficiency in marketing operations is one of the most pressing. It is the aim of the present study to investigate and evaluate the data, problems, and techniques of securing operational and cost efficiency in a single institutional type -- the department store.

Methodology.—Two mail surveys furnish a large share of the data on expense problems and management practices in department stores. Questionnaires were sent to 135 stores with estimated annual sales of $10 million or more. Fifty-three, or almost 40 per cent, returned usable information. The distribution of these returns by geographic area, type of ownership, and store size attests to the adequacy of the sample. More intensive questions were then asked of sixteen of the more progressive stores among the original respondents. Thirteen of these returned satisfactory questionnaires.

Observations and personal depth interviews with many executives in eleven leading department stores in the midwestern and southeastern United States were a valuable

source of case material on specific management and research practices and problems. A second major source of detailed information was a series of interviews, observations, and work studies undertaken, over a five-month period, in a large southeastern department store. Selection of the stores studied was guided by the advice of executives widely acquainted with operations in many stores, and by geographic opportunities and limitations. These interviews and observations were supplemented by correspondence with a limited number of executives and management consultants who could, it was believed, make important contributions to the study.

The analysis of expense levels and trends is based on material published by the Bureau of Business Research of the Harvard Graduate School of Business. Since 1921 their bulletins have contained the most complete compilation of retailing statistics published. Other published sources were investigated for information pertinent to the general problems of expense management, productivity analysis, and store operations.

THE PROBLEM

Retailing absorbs the largest single share of total marketing cost.[1] Of the major retail types, the department store is among those with relatively high operating costs. Data also show that expenses in large department stores are generally higher than in smaller stores. A careful analysis of the nature and characteristics of these cost differences brings out the fact that the higher expense ratios of larger stores result from variations due to different city sizes, differences in the importance of merchandise lines and the offering of more customer services, and the assumption of more wholesaling functions than are undertaken by their smaller counterparts.

One of the most unfavorable aspects of department store costs has been the secular increase in expense ratios. For the groups studied, there was an annual secular rise of approximately .33 per cent for the period 1929 to 1941. Data available for other store groups show a similar movement from 1920 to 1929. After the low expense ratios of the 1942-1945 period, many expenses have tended to return to trend levels extrapolated from the pre-war period. The primary sources of this secular growth have been more and higher taxes; greater outlays for selling supplies; purchase of delivery services; and higher payroll costs for salesclerks, other selling employees, and display workers. It is significant that most of these are generally considered to be controllable expenses. Failure to control these costs is evidence of a weakness in department store expense management. It further points out a need for an appraisal of existing expense management concepts and practices. Such a project would make a distinct contribution to scientific marketing.

EXPENSE MANAGEMENT PRACTICE

Expense management has both dynamic and static aspects. Those of a dynamic nature are concerned with the balancing of costs with operation levels over a period of time. Static aspects are concerned with expense reduction at one point in time. Any attempt to reduce or control expense raises a third aspect, namely, one of measurement.

Since 1945 there has been a growing interest in expense reduction. Even so, a store with a well-planned and coordinated expense reduction program is the exception. There has especially been a lack of study of expense reduction possibilities and operational efficiency in selling areas, although selling costs are high and have been increasing. Many stores make store-wide cost reduction efforts while ignoring the fact that high costs are often due to inefficiencies in the physical discharge of many detailed activities. Even in stores where progressive efforts are made, they are frequently carried out only in selected areas, in a haphazard manner, or by untrained personnel.

The most commonly used expense measurement is the "expense ratio to sales." It is a valuable financial accounting tool but is often misapplied in operational efficiency measurement. There has been a growing adoption of measurements based on transaction or specific work units, although they have not yet been installed by many stores, nor are they usually employed within stores as extensively as would seem justified. Many work term units are inappropriate for the work being measured, and have been developed and applied in an unscientific manner by unskilled persons.

Department store expense is usually controlled in terms of past experience. Control is almost always carried out with single-level budgets fixed for periods of from one week to six months. There is a strong tendency to shorten the budget period or to make more frequent comparisons of actual expense with that budgeted. There are also apparent trends toward a greater use of unit cost and physical production data for control, decentralization of control authority and responsibility, and a realignment of expense responsibility along lines of executive authority.

A CONCEPT OF EXPENSE MANAGEMENT

While most executives are not prone to consider the philosophical aspects of expense management, the study of actual practices uncovers certain managerial concepts. Those that characterize a more progressive approach are of special interest here.

All business institutions in a capitalistic society are charged with a definite obligation to give the public certain economic values known as primary service objectives. It is impossible, in the long run, to attain these ends unless the firm also achieves secondary business objectives in the form of "economy and effectiveness in the creation of primary values."[2]

Expense Measurement.—Expense, while superficially or technically an outgo, is actually an investment or input. As such, it should be evaluated in terms of the direct returns resulting from an input. Mechanically, this is the efficiency ratio of output/input. Maximum precision in the output/input ratio can best be obtained with cost and production standards that are expressed per unit of input. Physical standards give the most effective measure of input utilization, and cost standards combine the yardstick of physical utilization with unit input price.

Expense Reduction.—Expense problems exist within a given framework of policy, environment, competitive conditions, and methods and procedures. Of these, only the latter are susceptible to generalized treatment. In this area, major opportunities for reduction depend on greater efficiency of operations. For maximum success the reduction effort must be planned, organized, and controlled

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in conformance with sound management principles that recognize the community of interest between business, social, and personal objectives. Participation on all levels is imperative. Research must be the cornerstone of such a program.

Expense Control.—The major problem of expense control is that of maintaining balance under highly variable conditions existing within and between almost all normally used time units (e.g., day, week, month, season). Control of costs should be maintained at the source. Particularly in the case of nonselling expenses, many costs must be controlled where the work flow originates rather than where the costs are incurred. From this it follows that control must be decentralized. To maintain flexibility without sacrificing the control itself, it is important that budgeting tools be used that will compensate for frequent shifts in activity levels.

APPLICATION OF CONCEPT TO PRACTICE

Applications of many aspects of the suggested approach to expense management problems are found in department stores. With one or two exceptions, however, no store was found with a program that resembles a comprehensive approach to all three phases of expense management.

Expense Reduction.—At the outset of an expense reduction program, probably the most valuable single research technique is flow process analysis. Being well suited to many different situations with unlike characteristics, it is of value in the study of steps or movements in processing merchandise or information. Its successful use in the stores studied is evidence of its value as a basic tool for expense reduction.

Work simplification programs have been valuable where actively promoted. A comparative analysis shows the essential characteristics of the more successful programs to be training courses in the principles of motion economy and methods study, a formalized submittal procedure, and a system of rewards for accepted proposals. Success also appears to depend on the care with which the programs are installed and the degree of popular participation secured.

Several other research techniques, which seem to have at least limited application in stores, are motion and micromotion study, and activity analysis. In none of the stores studied have motion analyses been undertaken. While admittedly their application will be limited, experience in industry shows that substantial savings in time and effort can be made in routine types of work with motion study. Failure to use this technique is probably due to the many opportunities that still exist for the more general types of study. The reluctance of store managements to employ activity analysis, particularly in selling departments, can be traced to the difficulty in securing observational data. Improved camera study techniques, already tried experimentally, hold promise of securing data economically without creating an artificial atmosphere.

Many other approaches can be enumerated by which expense improvements may be secured. Important among these are changes in policies, the analysis of forms and supplies utilization, and mechanization. Many examples of worth-while economies resulting from the use of these approaches were found in the field studies.

Measurement Techniques.—The scientific approach to expense measurement must recognize the three factors of quantity, quality, and cost. Of these, quantity standards have received the widest acceptance in retailing. Although the general purposes of production standards appear to be understood, a study of their employment in stores shows that these aims are not fully attained because of inappropriate work terms and organization units and a general lack of rigor in application.

Production standards have been most widely adopted for routine tasks in nonselling activities. Most commonly they are computed criteria based on past production results gathered for periods of six weeks to six months. Time study measures, developed after careful methods and layout studies, represent the most advanced form of measurement. The success of the few time study standards found in stores shows the importance of scientific method in developing production measures.

There has been little effort to employ productivity concepts in selling activities. Although selling conditions are generally unstandardized and therefore less subject to precise measurement, rising costs in these activities justify giving greater consideration to possible measurement techniques. A major obstacle to progress comes from the lack of a precise output/input ratio. The "hours at work" input concept leaves much to be desired because of sporadic idleness in the sales force. A more meaningful sales production standard could be based on a transaction-traffic relationship. Although there has been only isolated experimental study along this line, the obstacles do not appear insurmountable.

While found in only one store, quality standards are needed to meet high service demands and to maintain quality where production standards are employed. Statistical techniques of quality control have definite applications in the reduction of errors, incorrect work, and the maintenance of service standards.

Standard or predetermined costs are prerequisite to an improved allocation of expense. With predetermined costs it has been found possible to reduce the arbitrarily prorated expense to as little as 15 to 20 per cent of total expense. In this manner, effective control is secured over costs that originate in one department but are incurred in another.

Expense Control.—In periods ranging from several years to only a few minutes, there are substantial fluctuations in department store work loads. Since there variations are primarily due to external causes, improved control must come from an enhanced ability to predict and compensate for these disturbances.

Two important requirements for effective adjustment to dynamic fluctuations in operations levels are found. First, it is imperative that stores employ budgeting and control tools that are better adapted to the task. Although the variable budget is the best tool yet developed for flexible control of costs, it is used in only two of the fifty-three stores surveyed. The most obvious applications are in nonselling departments, yet investigation shows that variable budgeting can be equally valuable in selling activities.

A second problem that has only partially been solved by store managements is that of maintaining a flexible balance between work force and work load. One of the greatest obstacles to flexibility is supervisor and employee prejudice. In nonselling areas, in particular, relatively fixed work forces have been maintained. Greater

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sales force mobility is being secured with part-time and contingent personnel and by interdepartmental shifting to meet peak loads. It is important to consider not only interselling, but also transfers between nonselling departments and selling-nonselling interwork. At present, a lack of knowledge concerning the causes and nature of short run variability thwarts a scientific approach to this problem.

CONCLUSIONS

From the study of department store operating statistics and from observations, surveys, and interviews, it is apparent that the problem of high and rising department store expenses is crucial. Better expense performance can be achieved in two forms. Changes in the framework of environment, policy, competitive conditions, and customer characteristics offer one avenue, but defy generalized treatment. A second approach to better expense performance is through enhanced cost-and-operation efficiency within this framework.

Although the seeds of sound expense management are liberally scattered throughout department store retailing, seldom is a comprehensive approach found. One of the major contributions of this study is the crystallizing of isolated attempts into a generalized concept of scientific approach to department store expense management problems. The first requirement of this approach is that a strong cost and efficiency consciousness be developed on the part of both management and employees. It is then necessary to develop a sound expense management plan that is properly organized and controlled. Such a program must necessarily be long run, cumulative in application, and designed to give adequate consideration to technical, personnel, and social considerations.

The evaluation of research techniques, budgeting and control devices, and cost and production measurement concepts presents a comprehensive study sorely needed for department stores. Problems of expense management are delineated, and the specific avenues of approach are more clearly shown. These paths are concerned with all three aspects of expense management--reduction, control, and measurement. Precise, meaningful yardsticks and techniques for the measurement of costs, quality, and physical quantity are needed. The widespread application of more refined research methods is required before significant criteria of static expense level can be determined. Finally, an improvement in the treatment of the dynamic problems must come after further investigation into the nature, causes, and relationships between costs, work force, and operations levels. An attack along these lines should enhance cost-and-operations efficiency in department stores, with resulting benefits to management, employees, and society in general.

387 pages. $4.95. Mic 58-4135

1. It is estimated that, in 1939, the cost of marketing goods in the United States was about $29.4 billion. Approximately 41.5 per cent of this represented retailing costs. See P. D. Converse, "The Total Cost of Marketing," Journal of Marketing, X, No. 4 (Apr., 1946), p. 389.

2. Davis, Ralph C. Industrial Organization and Management. New York: Harper & Brothers, 1940, pp. 23-28.

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RICHMOND, VIRGINIA AS A WHOLESALE TRADE CENTER: AN ANALYSIS OF ITS DEVELOPMENT AND PRESENT POSITION

(Publication No. 24,073)

Frederick Byers Miller, Ph.D.
The Ohio State University, 1952

Writers of history have recorded numerous cases of cities which have experienced periods of prominence as wholesale trade centers and then slipped into relative oblivion as important centers of trade. While the growth and decline of such centers are well known, there is a paucity of literature dealing with the causal factors. Too frequently the causes are rationalized after a considerable lapse of time rather than determined and recorded on a contemporary basis. This case study was undertaken to determine the basic factors which contribute to the growth and decline of wholesale trade centers through an analysis of the development and present position of Richmond, Virginia, as such a center.

Selection of Richmond for the case study. — Several criteria make Richmond a good setting for this case study. It has been a wholesale trade center for over two and one-half centuries. The area was colonized in 1609 by representatives of the Virginia Company, which was, in effect, a commercial enterprise engaged in wholesaling activities. The history of the city is closely related to the history of the United States, and the presence of an historically-minded society makes available a large amount of historical data. While at one time Richmond was one of the most important wholesale trade centers of the country, it has declined in relative importance in more recent years.

The History of Richmond as a Wholesale Trade Center

The first warehouse established in Richmond for purposes of trade was built between 1679 and 1704. Since that time the number of wholesale establishments has increased to 636, with total sales of $649,587,000 in 1948.

Pre-Civil War Developments. — Prior to the Revolutionary War the merchants of the city were British and Scottish representatives who traded largely with the planters. Their primary method of operation was to sell to the planters at collectively predetermined inflated prices and buy the products of the planters at similarly predetermined low prices. Credit was advanced and payment demanded when the planter became overextended. In view of the social and political position of the planter group, the relationship resulted in considerable antipathy toward the merchant group, and this feeling was not soon to disappear.

Richmond's early development as a wholesale trade center was a result of its location at the falls of the James River. This allowed the most economical combination of water and overland transportation to serve the hinterlands. As population moved westward, Richmond's volume of trade increased. Until the development of the steamship, the city was a thriving port for foreign trade. No attempts were made to deepen the channel of the river to accommodate the larger ships until the trade had been diverted elsewhere. When the railroads were extended to the Hampton Roads area, the city was effectively by-passed as a port.

By 1860, the wholesale merchants of Richmond had available approximately 1,000 miles of railroads and canal

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and were serving territory composed of Virginia, North Carolina, Tennessee, and what is now West Virginia. The available transportation facilities and low rates permitted the merchants to serve this territory with little competition from merchants located elsewhere.

The period of greatest expansion.— Immediately following the Civil War the Richmond merchants faced a difficult situation resulting from a scarcity of goods and capital and from the competition of northern merchants who were able to extend credit without which southern customers could not buy. It was not until about 1880 that the city's wholesale establishments were able to regain the position held immediately prior to the war. During this period the generation which knew at first hand the glories of the antebellum agricultural system began to disappear, and there was greater recognition of the possibility of developing Richmond as a center for trade. In 1880, the Richmond firms entered into the period of their greatest geographic expansion. In fact, there was greater interest in the vastness of territory served than in the degree to which the territory was penetrated. This philosophy of expansion was similar to that expressed in the earlier agricultural system of adding new acres as the yield on existing acreage declined. In 1900, the normal trading area of the Richmond establishments included Virginia, West Virginia, North Carolina, South Carolina, and parts of Georgia and Tennessee.

The annual dollar sales volume of Richmond jobbers and the capital invested in jobbing firms for the period 1890-1920 are presented in Table 1. From 1890 to 1920, dollar sales of Richmond jobbers increased from $31,543,000 to $151,301,000, an increase of 379 per cent, although there was no appreciable increase in the territory served after 1900. The increase in the physical volume of sales over this same period was about 73 per cent, which would indicate that most of the growth in dollar sales was due to price increases or to a reduction in the value of the dollar. The growth in physical volume of sales was greater than the 55 per cent growth in the population of the area served. The Richmond jobbers were able to increase dollar sales 379 per cent over the period, with an increase in capital investment of 160 per cent.

Table I

Annual Sales and Capital Investment
Richmond Jobbers
1890-1920
(In thousand dollars)

Year*	Sales	Capital	Year	Sales	Capital
1890	$ 31,543	$ 7,360	1906	$ 61,421	$ 11,552
1891	36,010	8,034	1907	n.a.*	n.a.*
1892	36,252	8,100	1908	67,855	12,272
1893	33,726	8,048	1909	68,050	12,718
1894	29,144	7,796	1910	71,672	13,225
1895	30,390	7,814	1911	74,459	13,442
1896	n.a.*	n.a.*	1912	78,298	13,635
1897	n.a.*	n.a.*	1913	80,807	13,708
1898	31,866	7,885	1914	79,818	13,727
1899	35,777	8,171	1915	79,824	13,738
1900	38,625	10,073	1916	82,659	14,106
1901	41,373	10,275	1917	96,459	15,871
1902	n.a.*	n.a.*	1918	120,935	16,850
1903	n.a.*	n.a.*	1919	151,350	18,272
1904	51,244	10,061	1920	151,301	19,191
1905	55,083	10,427			

Source: 1890-1901, Collected by J. H. Whitty and published in the Richmond Times, January 1, 1891-1902.
1904-1908, Collected by J. H. Whitty and published in the Richmond News Leader, January 1, 1905-1909.
1909-1920, Collected by J. H. Whitty and published in the Richmond Times Dispatch, January 1, 1910-1921.

*n.a. - Not available.

Developments since 1929.— Richmond wholesale establishments moved into the great depression in 1928. The downward movement was accelerated, if not started, by a ruling of the Interstate Commerce Commission which reduced intraterritorial freight rates. This decision resulted in the Richmond market's loss of South Carolina and made much of North Carolina highly competitive with establishments located in that state.

From 1929 to 1948 the dollar volume of sales of Richmond wholesale establishments increased 200.5 per cent, and the physical volume of sales increased 73.5 per cent. These increases were less than those experienced by wholesale firms throughout Virginia but greater than the increases throughout the United States. In 1948 Richmond continued to be the most important wholesale trade center in Virginia but dropped from thirty-fourth to forty-third position among the wholesale centers of the country as measured on the basis of sales volume. During the period 1939 to 1948 Richmond was displaced by Charlotte, North Carolina, as the most important wholesale trade center between Washington, D. C., and Atlanta, Georgia.

Between 1929 and 1948 the area in which the wholesale establishments of Richmond could compete favorable was further reduced by actions of the Interstate Commerce Commission. In 1935 the Commission found that certain rates between specified Virginia points, including Richmond, were unreasonable and unjust, in favor of Virginia cities over North Carolina cities, and ordered reasonable and just rates to be worked out.[1] The Class Rate Investigation of 1939 and the Consolidated Freight Classification of 1945 had additional limiting effects for Richmond establishments because the Commission ordered an increase of 10 per cent in Official rates and a decrease of 10 per cent in southern rates.[2] This change narrowed by one-half the differential in rates then existing between the two territories. As a result of these changes the normal area served by the Richmond establishments is now limited to the central counties of Virginia and a few counties in northeastern North Carolina.

In recent years the thesis has been advanced that Richmond is a "depression-proof" city. Support is given to

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this theory by the 1890-1920 data and by the 1929-1948 data. During periods of national prosperity, business activity in Richmond does not reach as high a level as it does throughout the country; on the other hand local activity does not fall to as low a level during periods of depression. Sales of Richmond wholesale establishments in 1935 were 16 per cent below the 1929 level, while sales of similar firms throughout the country were 36 per cent below the 1929 level. This condition results from a well-balanced economy, with diversified manufacturing activity and a large amount of government employment.

The Richmond tax situation.— Since 1948 the wholesalers of Richmond have advanced the claim that the wholesale merchants' license tax levied by Virginia and Richmond has been discriminatory and has resulted in an unfavorable competitive situation for the local establishments. At the present time both the state and city levy a tax for revenue purposes which is based upon gross purchases. Data resulting from a survey of 1949 tax returns were analyzed to determine the validity of this claim. Taxes were calculated which a hypothetical average-sized firm in each of four lines would pay if it were located in selected Virginia cities and selected cities in neighboring states. The analysis indicated that the Richmond firms had no practical competitive disadvantage insofar as day-to day price competition was concerned. On the basis of the relationship between the amount of tax and net income, the lower-margin, fast-turnover type of operation appears to have a long-run competitive disadvantage because of the possible impact of the tax load upon the attraction or accumulation of capital. On the other hand, the higher-margin, slow-turnover operation has an equally great competitive advantage over similar firms located elsewhere insofar as the relationship between taxes and income is concerned. Application of taxes based on other than gross purchases results in similar discrepancies except for a tax based upon net income. The Virginia constitution prohibits the localities from levying any form of tax which is based upon income.

Comparison of Charlotte and Richmond.— Since 1939, Charlotte, North Carolina, has experienced much greater growth as a wholesale trade center than has Richmond as measured on the basis of sales volume. From 1929 to 1948, sales of wholesale establishments located in Charlotte increased 435 per cent or more than twice as much as did sales of Richmond establishments. Manufacturers' sales branches and offices represent the predominant type of wholesale operation in Charlotte, and accounted for the greatest share of the increase. A survey was conducted among branches and offices of national firms located in Charlotte only, and among those located in both cities, to determine the basic causes of the greater growth in Charlotte. Several facts were established by the survey. (1) Much, but not all, of Charlotte's growth resulted from the tremendous increase in textile manufacturing in that territory. This is a kind of economic activity for which Richmond is not well situated. (2) The dominant segments of Charlotte's population are more progressive in their attitudes toward growth and industrial development than are those in Richmond. (3) The majority of business firms do not have a definite policy and do not follow a predetermined procedure in selecting a location for a sales branch or office. (4) Other causes given for Charlotte's growth are primarily rationalizations and are not borne out by fact. As compared with Charlotte, Richmond has superior transportation facilities, a better-balanced economy and equal power facilities, housing, labor supply, and climate. One can only conclude that business development programs such as those operated through the Charlotte Chamber of Commerce can be successful in attracting wholesale establishments and other forms of business activity to a particular city.

The Causal Factors of Growth and Decline

The study has established certain factors which appear to be determinants in the growth and decline of a wholesale trade center. Certain of these factors can be classified as economic, and are clearly distinguishable. Other non-economic factors are less tangible but are of equal importance, and may be controlling.

The economic factors.— The location of Richmond, which was due primarily to geographic factors, played an important part in its development as a wholesale trade center. While there were early attempts to legislate other trade centers into existence at the time Richmond was established, those centers have disappeared from the Virginia scene.

Authorities have long accepted transportation as a basic factor which influences the development of trade centers. While it is obvious that adequate transportation facilities are essential for the establishment of a market, the study indicates that transportation rates are of greater importance in controlling the growth and decline of wholesale trade centers. Richmond's expansion in territory served was made possible by low rates, resulting, first, from competition, and later, from regulation.

Population exerts differing influences upon a wholesale trade center. It determines to a large degree the potential of any area for development into a strong market. As population increases within the area in which wholesale establishments of a given city have competitive advantages arising from lower transportation costs, the potential of the market is increased, and greater sales result. On the other hand, as population increases and becomes more highly concentrated, additional trade centers develop and firms located therein offer increased competition to existing firms located in older centers. The increased use of truck transportation has permitted wider development of small wholesale trade centers. It is also apparent that a steady growth of population permits existing industry to absorb the increased working force, which in turn creates greater economic stability.

Wholesaling is a resultant of other economic activities, such as manufacturing and agriculture, and the development of a wholesale trade center is related directly to the level of economic activity in the area served. Such activity creates a market potential which results in greater wholesale sales.

The non-economic factors.— It is quite possible for a city to have many of the economic factors which would permit it considerable growth as a wholesale trade center but to have those factors effectively negated by the attitudes of present wholesale establishments and of the public at large. As a city becomes older and has experienced years of success as a wholesale trade center, certain firms may adopt the attitude that the city has an inherent right to be such a center and, therefore, will always be one. This attitude blinds such individuals to changes which take place in the economic situation and prevents wholesale

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establishments from presenting a common front for the solution of problems with which they are collectively faced. Such an attitude is also reflected in slowness to adopt modern operating techniques.

Of equal importance in determining the development of a city as a wholesale trade center are the attitudes of the dominant segments of the city's population. If that society is highly conservative and tends to dwell in the glories of the past, there can be little progress in business expansion. Furthermore, if such a society considers wholesaling to be a less honorable activity than the professions, manufacturing, or agriculture, the city cannot reach its greatest potential as a wholesale trade center.

Use of the Factors for Prediction

The basic factors established by the study can be used for the purpose of forecasting the future of a city as a wholesale trade center. When these are applied to the Richmond situation, one must conclude that not only is there little chance for expansion of the present market area, but that further encroachment may be made on the existing area by firms located in Washington, D. C., and various cities in North Carolina. Furthermore, there is little reason to expect much relative increase in volume in the present territory so long as the present attitudes of the public at large and those engaged in wholesaling continue to offset such natural advantages as the city may have. This condition can be changed over an extended period by the individual and collective action of present wholesale establishments. 260 pages. $3.35. Mic 58-4136

1. Interstate Commerce Commission. Annual Reports. Washington, D. C.: Government Printing Office, (1938) vol. no. 213, p. 259.

2. Interstate Commerce Commission. Docket Number 28300, "Class Rate Investigation, 1939," and Docket Number 28310, "Consolidated Freight Classification" (Mimeographed). Washington, D. C.: Interstate Commerce Commission, Mimeographed, sheets 10 and 11.

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AN INQUIRY INTO SOME ASPECTS OF MANAGERIAL DECISION-MAKING

(Publication No. 25,130)

Robert William Morell, Ph.D.
St. Louis University, 1957

From the beginning of the twentieth century when Frederick W. Taylor, the father of modern management, ushered in "scientific management," there has been a steady evolution of thought in the field of management. Since science in management means the displacement of traditional methods of management by more rational methods, it is not surprising to find the "rule-of-thumb" managerial decision being subjected to challenge. An intellectual break through is shedding some light on the processes of decision-making. The penetration is occurring in many areas of study, such as operations research, philosophy, anthropology, sociology, logic, psychology. Because it is impossible in a single thesis to cover the relevant contributions of all the specialists who have something important to contribute to decision-making, this study is limited to an investigation of the relevent contributions of logicians to the management activity of decision-making.

An analysis of the opinions of a number of authorities with respect to the stages of decision-making clearly indicates that despite minor differences among the specialists, there is substantial agreement on the following pattern of decision-making:

(1) A feeling of uncertainty or doubt.

(2) An analysis of the problematic situation which generates the problem.

(3) The proposal of hypotheses.

(4) The deductive treatment of hypotheses.

Stage (1)--a feeling of uncertainty or doubt--is a function of the state of development of a manager's conceptual structure. A well developed conceptual framework is sensitive to problems. On the other hand, a less well constructed system of ideas may fail to provide the necessary awareness of a problem and the accompanying uncertainty as to what to do about it. In stage (2)--analysis of the problematic situation--a manager seeks to discover the relevant facts in order that the problem may be defined. The problem statement of stage (2) plus the manager's previous knowledge may then be used to suggest relevant hypotheses--stage (3).

In stage (4), the logician makes his cardinal contribution to decision-making. With respect to this stage, the experts prescribe that hypotheses be stated in propositional form in order that the implications of the propositions may be discovered. The discovery of what propositions imply in order that valid decisions may be derived from them necessitated a study of propositions. Yet the implications of propositions must not be confused with the inferences or decisions based upon the implications. The distinction of "inference" from and its connection with "implication" was, therefore, carefully developed. When an implication holds for an arrangement of premises, and for the terms of premises, a "validating form" for decision-making exists. Finally, the "validating forms" for decision-making were carefully examined.

Conclusions are presented in this study which are believed to be pertinent to decision-making by an individual business manager. Some of these proposals are somewhat severe because they necessitate changes in existing methods of decision-making as well as changes in curriculums of collegiate schools of business. However, they must be considered seriously if management is to place its decision-making on a more intellectually rational basis.

188 pages. $2.45. Mic 58-4137

AN ACTIVITY CONCEPT OF THE BUSINESS ENTERPRISE AND ITS IMPLICATIONS IN ACCOUNTING THEORY

(Publication No. 25,259)

Helmi Mahmoud Nammer, Ph.D.
University of Illinois, 1957

Two schools of thought exist as to the nature of the accounting entity, each of which is intended to serve as an integrated framework for accounting theory and each of which has been subject to many criticisms. It is a hypothesis of this dissertation that both concepts are based on assumptions with respect to the structure and behavior of a business organization that are not in accord with the facts. The first objective of this study is to examine the validity of the above hypothesis; the second is to develop a realistic concept of the business enterprise.

Economic and legal aspects of internal structure, actual ownership, the nature of management, and the ultimate objective of a business organization lead to two major conclusions:

(1) The proprietary concept of the accounting entity is based on assumptions with respect to ownership, management, and the ultimate objective of the business enterprise that have been greatly influenced by the legal nature and classical economic ideas of the firm. Such assumptions are not valid in the light of economic facts of the corporate form and its activities.

(2) The entity concept is also based on assumptions with respect to ownership, management, and the ultimate objective of the business organization that cannot be justified on a legal or economic basis.

As a substitute for the traditional concepts, an activity concept of a business enterprise has been developed which is based on the idea that a business organization is "a complex system of formal and informal coordinated activities for the purpose of creation or transformation and distribution of utilities." The activity concept makes it possible to join together the view that the business enterprise is a productive economic entity and the view that it is a method of doing business for the participants.

The underlying assumptions of the activity concept with respect to the structure and behavior of a business organization are based on economic facts rather than legal considerations. Under the activity concept, the entity is regarded as the asset holder and long-term investors are considered to be the true asset owners, ownership and management are two basic factors that are mutually influential, and survival and growth are the ultimate goals of the business enterprise.

The activity concept has far-reaching implications in accounting theory. Three fundamental areas in accounting are selected for discussion. These are the nature of assets, the nature of capital, and the nature of income. After evaluating the traditional concepts in these areas, the thesis arrives at the following major conclusions consistent with the essence of the activity concept:

(1) A definition of assets should emphasize service potential and beneficial interest as the basic attributes of assets.

(2) Capital is best considered to be the expression of the long-term investment equity in the assets.

(3) The balance sheet equation should be stated as follows: Assets - Short-term Liabilities = Net Worth + Long-term Liabilities

(4) Income should be defined in terms of the enhancement in the enterprise assets.

(5) Two income figures should be reported in the income statement: operating income to measure the success of the enterprise as a productive economic entity, and owners' income to measure the success of the enterprise as a method of doing business for the owners.

The activity concept as developed in this dissertation is not unique to accounting, but it can be of great usefulness for accounting purposes. It has superiority over the traditional concepts in that it is based on a realistic analysis of the structure and behavior of the business enterprise, and insofar as it makes any personification of accounting definitions and concepts unnecessary.

216 pages. $2.80. Mic 58-4138

THE COMMERCIAL APPLICATIONS OF ELECTRONIC DATA PROCESSING EQUIPMENT

(Publication No. 25,264)

Richard Fisher Peirce, Ph.D.
University of Illinois, 1957

The development of electronic data processing equipment has given to business the opportunity to eliminate an enormous amount of clerical work. The need for this is clearly shown by the increasing percentage and numbers of the working force employed in clerical operations. This thesis describes how a large percentage of this clerical work can be performed on data processing systems.

Five types of clerical operations are performed by most businesses. These include payroll, inventory control, purchasing, sales order handling, and general and cost accounting. The procedures required to convert these clerical operations are reviewed in detail. A program for the installation of a payroll system indicates the steps to be followed in making the analysis, programming, coding, and conversion for the new system. Flow charts indicate the sequence in which data are handled.

The same characteristics which enable data processing systems to perform clerical operations also permit them to prepare interpretive information for management. The contribution which data processing equipment will make in this area will be at least as important as the contribution in the clerical area. The use of this equipment to prepare budgets is described to illustrate the interpretive operations which can be performed on this type of equipment.

The ability to perform as many as several thousand operations each second permits a data processing system to do vast amounts of work. Reports can be prepared within an extremely short time after the source materials are available. Needed information which is not feasibly obtained under manual methods because the time required

to prepare the data is so great that the information is no longer usable can now be obtained.

High speed would be of little advantage if a sequence of operations could not be executed without manual intervention. In most clerical operations a routine decision must be made after the execution of a limited number of steps. An advantage of these systems is that no manual processing is required from the time source data are transcribed to magnetic tape until the final output is prepared. This is achieved because the equipment has the ability to make logical choices.

Without accuracy of operation none of the other advantages of the system could be secured. But with proper design and maintenance a system can achieve a degree of accuracy far better than humans.

Just as most of the advantages of a data processing system can be summarized in one final factor--cost, so can the disadvantages. However, the elements that contribute to cost can be distinguished. Equipment costs are extremely high and the adoption of one of these systems usually requires radical changes in methods.

The primary factor now delaying the adoption of these new systems is the lack of detailed knowledge of methods for their use within individual companies. The American standard of living will be raised when greater knowledge of these systems permits their widespread adoption.

289 pages. $3.75. Mic 58-4139

THE CONCEPT OF "OPERATIONS" IN ACCOUNTING AND ITS INFLUENCE IN INCOME DETERMINATION AND INCOME THEORY

(Publication No. 25,283)

Suthee Singhasaneh, Ph.D.
University of Illinois, 1957

The purpose of this study is to develop the accounting concept of "operations" and to determine its usefulness and implications in the areas of income determination and income theory.

The primary step toward this objective involves an analysis of business transactions in order to reveal similarities, dissimilarities, and relationships among them. A significant group of transactions is found in profit-seeking transactions which deal with the utilization of funds contributed by various financial interests for the purpose of creating income. Various possible classifications of profit-seeking transactions are attempted which reveal many significant characteristics of these transactions. These provide a foundation from which the characteristics of "operations" are pointed out.

Interpretations of business enterprise operations by accountants, economists, and financial analysts are studied in order to determine current ideas in these related fields. Out of these ideas of operations, an integrated pattern of related ideas may be developed.

The characteristics of business enterprise operations revealed in this study are as follows:

1. Enterprise operations involve the income-producing activities. This would exclude all transactions dealing with financing including distributions of income to various financial interests.

2. In its operations, the enterprise acquires assets and utilizes the services of these assets in creating products. The end result of the process of operations is the realization of revenue from the sale of these products to customers.

3. Enterprise operations are planned by management which is held responsible for the efficiency of operations.

4. Enterprise operations are current to the period in which they are reported.

From the above characteristics of enterprise operations, the accounting concept of operations may be described as follows:

"Business enterprise operations include only income-producing activities, planned by management for the creation and sale of products and services, and are reported in terms of revenue realized from these activities during the current period and related costs."

The usefulness of this concept is tested by applying it to problems in income theory. Practical applications of this concept are possible in two accounting areas - income determination and income reporting. Some interesting points revealed in this connection are that normal losses should be treated as operating expense, broadly conceived; the practice of income stabilization is not desirable because realistically operating results are subject to fluctuations due to varying business fortunes of one year as compared with another; and it is desirable to report operating items separately in the income statement so that significant information regarding operations may be clearly disclosed.

There is a close relationship between the concept of operations and the entity concept. Some of the ideas included under the concept of operations are developed by using the entity concept as a starting point. The concept of operations is recognized in all recent formulations of accounting theory. However, the implications of this concept do not represent a uniform pattern of related ideas. The relationship between income from operations and business income is that operating income represents a part of business income and it is distinguishable from other components of business income because of its direct relationship to managerial efficiency.

The primary usefulness of the concept of operations is in the area of income reporting. In this connection, this concept provides a basis for grouping income statement items for better interpretation. Reporting a figure of operating income provides a measure of managerial efficiency in the utilization of funds to produce income.

196 pages. $2.55. Mic 58-4140

THE INFLUENCE OF CONSUMER DEALS ON URBAN HOUSEHOLD PURCHASES OF BUTTER, MARGARINE, VEGETABLE SHORTENING, AND SALAD AND COOKING OILS IN METROPOLITAN CHICAGO

(Publication No. 24,927)

Lynn Homer Stockman, Ph.D.
Northwestern University, 1957

The effectiveness of one-cent sales, coupons, two-for-one sales, and other consumer deals constitutes a controversial topic among many marketers. Some of the

divergence of opinion stems rather obviously from the vested interests of those concerned. A greater part, perhaps, arises from a lack of unbiased information concerning the real influence of deals on consumer purchases.

This study was undertaken to provide some of the answers as they pertain to urban households in Metropolitan Chicago during the period July, 1953 through June, 1955. Basic data emanated from a static sample of 555 households selected from among those comprising the continuous consumer panel maintained by the Research Department of the Tribune Company.

A grant from the United States Department of Agriculture provided funds with which to obtain the historical purchase records used in the study. The same funds also defrayed a substantial part of the processing and other costs incident to the analysis of almost 60,000 individual purchases.

The following are the major findings of the study:

1) Consumer deals were virtually nonexistent in purchases of butter. For each of the other three products, relatively small numbers of heavy-dealing families accounted for a disproportionately large percentage of all reported deals.

2) Those reporting the heaviest participation in deals were found primarily among the heavier-purchasing households. In addition, they typically posessed the following characteristics: they were white families (nonwhites reported very few purchases involving deals,) they had above-average incomes, they were the larger families and those in which children were present, the housewife was under 45 years of age, and the head of the household had completed more years of schooling than had those reporting less deal participation.

The major conclusions reached are:

1) Deals appear to have had little, if any, influence in inducing a first (or trial) purchase of any of the four products studied. Deals probably had only a minor influence on the volume purchased, on the frequency of purchase, or in bringing about the substitution of margarine for butter.

2) Deals probably had some influence in inducing a few consumers to try a new brand, or to repurchase a brand which had not been bought for six months or more. This may have extended to as many as 25 or 30 per cent of all deal purchases of margarine and shortening, and to 10 or 15 per cent of the salad and cooking oil deal purchases. (It should be pointed out, however, that approximately six per cent of the total volume of margarine and oils was reported as purchased on deals. In this perspective, the influence of deals was limited to relatively few households. For shortening, approximately seventeen per cent of the total pounds were reported as deal purchases. Thus, for this product, the influence of deals was probably somewhat greater.)

3) For all deal purchases, about one-third of those involving margarine and oils very probably represented additional purchases of brands that were, at the time of the deal, being purchased as much as, or more than, other brands. For shortening, it is probable that about half of all deal purchases were simply additional purchases of a favored brand.

4) Few families evidenced any consistency with respect to brands purchased before, during, and after deals. The majority of those who participated in any deals tended to buy deal brands when they were available on deals and to purchase other brands to a greater extent at other times. 338 pages. $4.35. Mic 58-4141

A SURVEY OF ELECTRONIC DATA PROCESSING AND ITS POTENTIAL IMPACT UPON ACCOUNTING PROCEDURES, PERSONNEL, AND EDUCATION

(Publication No. 25,180)

Robert Theodore Tussing, Ph.D.
The University of Texas, 1957

Supervisor: Dr. Charles T. Zlatkovich

The recent emergence of the term "Electronic Data Processing" (frequently called "EDP") has focused attention upon the data processing problem as one common to all business activity today. Most writing on the subject so far has, however, been fragmentary and filled either with vague and sometimes glowing generalizations or with confusing details peculiar to a particular case.

The major purpose of this dissertation has been to present a non-technical description of EDP equipment, the EDP method, and actual and proposed applications, comprehensive enough to provide a general understanding of the field--a basis upon which to build a more intensive study in any desired area of specialization. For the most part, this dissertation is a distillation and synthesis of information available from published and unpublished reports. It is also based upon field interviews with seven different firms which have installed or are installing EDP equipment, conferences and correspondence with representatives of equipment manufacturers, and discussions with several educators who are pioneering in the field. Emphasis was placed upon accounting applications on the basis of the contention that the controller's department is the center, or point of focus, of business data processing activities.

EDP is described as a method of processing information in dynamic form, with the speed of electronic circuitry, and the flexibility of internal programming. An electronic computer is defined and described functionally. The types and importance of auxiliary equipment are discussed. A brief outlined of the evolution of the equipment and its early applications in business are presented.

Some representative accounting applications are described in basic terms and potential contributions of the method to management and control are discussed realistically. Personnel requirements and problems in converting to EDP are discussed, with a description of the new positions which are being created.

An organizational pattern for investigating EDP possibilities for a particular firm is outlined, along with two approaches to analysis of procedures: the "conventional" approach of attempting to convert present processing to an EDP system, and a proposed new "Central Files Approach" to creative systems analysis. This latter concept is based upon the notion that most useful information

is already being collected in some central records file, or could be, as a by-product of gathering essential information. Instead of tracing an information-processing chain from source document to ultimate disposition, this approach focuses upon the point where the data has been assembled and projects the analysis in either the direction of gathering or utilization. Processing chains are thereby cut in half.

To give a specific illustration of the significance of many of the factors, a case study is presented which includes a description of the organization, equipment, and activities of a data processing center before and after conversion to a medium-scale EDP system. There is also an analysis of differences and a consideration of major factors involved in the changeover, a summary of improvements which have been achieved, and a projection of possibilities offered by a large-scale EDP system.

The need for including EDP in the curriculum of a collegiate school of business is considered. Several possible courses of action are discussed, ranging from simple orientation presentations to the development of a full-fledged major field of study in the area of systems and controls. Equipment with which the ideal of integrated data processing can be achieved is now available. Its effective utilization depends upon the creative ability and thinking of people. 286 pages. $3.70. Mic 58-4142

ECONOMICS, FINANCE

FEDERAL GRANTS-IN-AID AND STATE TAXES: A STUDY OF THEIR EFFECT UPON MAINE INDUSTRY

(Publication No. 23,420)

Kenneth George Ainsworth, Ph.D.
Brown University, 1957

The present study describes the existing federal grant-in-aid programs, critically evaluates the analysis of such programs, and suggests an alternative method for analyzing grants-in-aid. Generally speaking, there is agreement about the objective characteristics of the grant-in-aid arrangements. The federal government helps and encourages the states to provide substantial amounts of public services. Although the magnitude of the programs themselves is sufficient to attract attention, the unusual degree of federal-state cooperation involved accounts for much of the special study of this type of program.

Prior analysis, especially of the effects of grants-in-aid upon states, has frequently put special emphasis upon the services provided and their economic consequences. In doing this, the incidence of federal taxes (the source of the aid) was generally compared with payments in aid of services (the purpose of the aid) to the various states. States are then said to gain (or lose) as the payments exceed (or fall short of) the taxes. Such a comparison, however, fails to recognize the economic importance of the services in a particular state to people and industry in other states. Beyond this, the role of the states themselves in these programs is frequently set forth in terms which are not comparable with those used in the analysis of the federal government's part in the program. Thus the studies undertaken to determine the effects of grant-in-aid financed services upon the states have used procedures which do not take account of important economic relations.

The second point of the critique is in effect a redefinition of grants-in-aid. Grants-in-aid are not equated to the services financed in this way, but are thought of as a financial device or a way of paying for services. This is done because it seems most likely that the services financed in this way would have been provided in any event. Therefore, to see the effects of grants-in-aid it is reasonable to assume a given level of services and consider alternative methods of financing them.

Taking account of the preceding criticisms, a determination of the differential effects of grants-in-aid upon Maine industry is made. In doing this, grants-in-aid are considered as a financial device rather than as a factor which has much influence on the level and distribution of services. The analysis uses data from the public assistance and highway construction programs for 1954. The present grant-in-aid method of financing these services is compared with statewise neutral financing, that is a way of financing which would have the same influence on similar industrial enterprises regardless of their location. The results indicate that in 1954 there was a rather persistent pattern of economic pressures upon Maine industry which was attributable to the use of grants-in-aid. In many cases these pressures were of such magnitudes that they might well influence the location of industry.

141 pages. $2.00. Mic 58-4143

PUBLIC POLICY TOWARD TAX DEPRECIATION ALLOWANCES: A STUDY OF ITS INFLUENCE ON BUSINESS DECISIONS AND THE FUNCTIONING OF THE ECONOMY

(Publication No. 23,805)

Dwight S. Brothers, Ph.D.
Princeton University, 1957

This dissertation is a study of past and present public policy toward tax depreciation allowances in the United States and of the influence of this policy on business decisions and the functioning of the economy. Tax depreciation policy and the effect of changes in such policy on business investment decisions, the aggregate amount of investment expenditures, and resource allocation is of principal concern; but the relationship between changes in tax depreciation policy and business decisions regarding prices, dividends, and other expenditures is also considered.

It is found that in most circumstances the direction in which business investment expenditures tend to be influenced as a result of change in tax depreciation policy is determinable, but that at best only rough estimates of the extent to which such expenditures are influenced are possible. It is also found that while adjustments in prices, in dividend disbursements, in wage and salary levels, and in certain other tax-deductible business expenditures may result as a consequence of change in tax depreciation policy, usually any influence exercised by such a policy

change on business decisions concerning these matters cannot be isolated. And it is concluded that change in tax depreciation policy is not likely to be effective when employed as a contracyclical fiscal policy measure.

Discussion of changes in public policy toward ordinary tax depreciation allowances instituted in 1934 and 1954 and of those special rapid amortization programs introduced in 1940 and 1950 constitutes a substantial portion of the dissertation. However, all significant changes in tax depreciation policy which have occurred since such policy was initially established in 1909 are described and commented upon.

The dissertation is divided into seven chapters. Following the introductory chapter are three chapters of a theoretical nature in which the effects of hypothetical changes in tax depreciation policy on business decisions and the functioning of the economy are investigated. This theoretical section is followed by two chapters in which past and present tax depreciation policy is described and the effects of changes which have occurred in this policy are analyzed. Separate consideration is given to public policy toward ordinary tax depreciation allowances and to extraordinary tax allowances for capital costs which have been provided for during periods of national emergency. In the final chapter of the dissertation the principal arguments and conclusions are briefly summarized and several observations are made with reference to future tax depreciation policy. 252 pages. $3.25. Mic 58-4144

AN ECONOMIC ANALYSIS OF THE EFFECTS OF WAGE ESCALATORS ON THE LEVELS OF PRICES, INCOMES AND EMPLOYMENT

(Publication No. 24,907)

Dudley W. Johnson, Ph.D.
Northwestern University, 1957

Wage escalation ties wage changes very closely to the price index. Its effects became significant in the American economy during the Korean War. After the Korean emergency subsided, the use of escalator clauses diminished. Since 1955, with further price increases, interest in wage escalation has been renewed. However, in other countries throughout the world, the index regulation of wages was introduced much earlier than in America.

The major purpose of the present study is to determine how, if at all, wage escalation contributes to rising prices or serves to modify the impact of an inflationary gap. The inflation rate is affected by escalation because it alters the timing of wage rate increases, and such timing aspects of escalation may result in contributing to rising prices.

The data indicate that escalators reduce the short-run inflexibility of wage rates-- under escalation, wages are changed more frequently than under ordinary fixed wage scales. The evidence for the American economy during the 1950-1952 inflationary period also indicates that this increased sensitivity of wages to price level changes, along with the degree of uniformity in the wage level increases, may be accounted for by the presence of escalation.

The influence of escalation on the rate of any inflation is directly related to the unusual frequency and automatic character of the escalator adjustment. Given an inflationary situation and no escalation, wage rate increases and their timing depend on the strength of the unions and the duration of wage agreements, along with the extent to which employers are willing to bid up wages. When escalators are introduced, the timing and the magnitude of wage increases follow automatically. As a result, the pace of an inflation differs from that which would occur under fixed term wage scales where short-term stability in wages is the usual case. The use of escalators accelerates the inflation rate.

This price-accelerating effect of escalators can, under certain conditions, constitute a new inflationary force in the sense that prices will rise by a greater amount than would occur were escalation not present. Whether this occurs depends on the influence of the acceleration in the inflation rate upon fiscal-monetary policy. It is likely, too, that escalation might sufficiently influence fiscal-monetary policy so as to constitute a new inflationary force, since the index regulation of wages may reduce the efficacy of the fiscal system as a tool to combat inflation.

The escalation of wage payments may also reduce the deflationary effects of certain types of taxes. Not only do taxes have income effects, but some have cost effects-- those that affect the cost of production. If taxes affect the cost of production, the result will be a rise in the price index (assuming, of course, that conditions are such that the tax can be passed forward). Under escalation, the rise in the price index will escalate income payments, reducing the deflationary effects of the tax. If the tax system is not manipulated sufficiently to counteract this effect, or if this fiscal rigidity is not compensated for by a more positive monetary policy, a new inflationary force is created, and prices will rise by a greater amount than would occur without escalation. The evidence presented by Denmark's experience with escalation seems clearly to point in thisdirection.

However, to the extent that the fiscal-monetary system's ability to combat inflation is not reduced by the expectational and price-accelerating effects of escalation, wage escalators help to determine which prices and wages will rise most quickly and most strikingly. But under these conditions escalation does not exert any strong or predictable effect on the extent to which all prices and wages rise.

Whether or not the tax systems of countries that make extensive use of the cost-of-living criterion in wage determination are, or will be, adequately manipulated so as to counteract the rigidities imposed by escalation is a question of policy. The same observation holds true for the reaction of monetary control to escalation. However, escalation makes the job of inflation control more difficult, which may raise significant issues in regard to fiscal-monetary policy. This fact, along with the accelerated inflation rate caused by escalation, may result in a net contribution to rising prices.

326 pages. $4.20. Mic 58-4145

EXCISE TAXES AND INFLATION CONTROL, THE CANADIAN EXPERIENCE, 1939-1957

(Publication No. 25,288)

Jared Sparks, Jr., Ph.D.
University of Illinois, 1957

In recent years the Canadian Government has made considerable use of excise taxation as a tool for inflation control. This thesis describes the Canadian system of excise taxes in terms of structure, administration and development, and attempts an assessment of the effectiveness of Canadian excise taxes in curbing inflation. Particular emphasis is given to the time period between the outbreak of the Second World War and the end of the Korean War. The method used for evaluating the effectiveness of excise taxation in controlling inflation involves first a comparison through time of excise tax yields and personal disposable income within a framework of the major forces influencing income and expenditure. Second, case studies attempt to relate monthly movements in prices and unit sales of selected consumer durable goods to movements in the relevant excise tax rates. The case studies are limited to the period of the Korean War. This period constitutes the single opportunity to examine excise taxes imposed primarily for demand shifting purposes in a period relatively free from direct controls.

The case for excise taxation as an anti-inflation device may be summarized briefly. First, excise taxes yield revenue and serve to lower the amount available for spending out of a given level of disposable income. Second, excise taxes may be used to shift demand away from particular goods. Finally, excise taxation may be used to supplement income taxes where increases in income tax rates may have adverse incentive effects. It should be noted, however, that excise taxes discriminate against individuals who for reasons of preference purchase taxed goods. A less discriminatory tax on expenditures, e.g., the general manufacturers sales tax, could yield revenue and supplement income taxes.

On balance, the weight of the evidence presented in the study appears to cast serious doubt on the desirability of the continued use of excise taxation as a tool for inflation control. During periods of high rates and broad coverage, excise taxes have yielded substantial amounts of revenue. But in view of the discriminatory character of broad based excise taxes, such taxation can hardly be justified in terms of revenue alone. During the period of the Korean War when relatively more postponable items of consumer demand (e.g., consumer durable goods) were important in the excise tax base, such taxation did perform a demand shifting function. The use of excise taxation as a demand shifting device however, is subject to serious limitations. First, it is extremely difficult to find the correct rates for the problem at hand. Second, frequent attempts to adjust rates to conform to changing conditions of demand and output may lead to destabilizing buying patterns based on consumer and business anticipations of rate changes.

In every case examined movements in excise tax rates were immediately reflected in retail prices. The September 1950 rate increases were insufficient to stem the rising tide of "scare buying" initiated by the Korean War. In this case rates were obviously too low. The rate increases in April, 1951, on the other hand, appear to have been too high. Following the 1951 rate increases, sales of consumer durable goods fell to a lower level than output conditions warranted, and continued to be depressed until the excise tax reduction in April, 1952.

223 pages. $2.90. Mic 58-4146

INSTALMENT CREDIT TERMS, CONSUMER BEHAVIOR, AND MONETARY POLICY

(Publication No. 25,396)

Lawrence Leonard Werboff, Ph.D.
Stanford University, 1957

Specific controls over the down-payment and maturity terms of consumer instalment loan contracts, although first proposed as an aid toward general economic stability, were applied just prior to World War II in order to curb consumer demand for durable goods and release resources for defense production. Since the end of the war controversy has developed over the continued use of such controls, particularly over granting the Board of Governors of the Federal Reserve System stand-by authority to impose them. Most recently the issue arose following the sudden increase in consumer spending and borrowing in 1955. In the discussion surrounding the question, no attempt was made to predict the effects of altering credit terms on consumer spending or consumer instalment debt. This study is an attempt to do this, and to examine the possible economy-wide repercussions of resulting changes.

One of the first problems involved finding a measure of down-payments and maturities on instalment contracts. Several alternative methods of making such estimates are described, and time series indices for both down-payments and maturities (from 1940 to 1955) are presented.

These indices of credit terms are then combined with other relevant variables in several models attempting to explain consumer spending on durables goods (C_d). The multiple regression model finally chosen for providing a satisfactory explanation of the observed expenditures involves the use of five independent variables: personal disposable income (Y), personal liquid asset holdings (L), the index of maturities (M), the index of down-payments (D), and a dummy variable (K) to account for the post-Korean anticipatory buying wave.

The period covered is from 1947 through 1955, and quarterly data are used. Consumers' durable goods expenditures, disposable income, and liquid asset holdings are expressed in real terms and reduced to a per-household basis. Disposable income is a lagged variable (one quarter), and liquid asset holdings at the beginning of each quarter are used. Two other variables--the relative price of consumer durable goods and the consumer-held stock of durables--were tried and rejected because their contribution to the explanation was either negligible or contrary to the a priori assumptions of the model.

The final equation and the relevant statistics are:

$$C_d = -327.67 + \underset{(28.4)}{133.65K} - \underset{(1.2)}{2.82D} + \underset{(.6)}{.81M} + \underset{(.06)}{.10Y} + \underset{(.04)}{.15L}$$

$\bar{R} = .80$
$\bar{S} = 37.91$

$\bar{R}$ is the coefficient of correlation and $\bar{S}$ the standard error of the equation adjusted for degrees of freedom. Numbers in parentheses are standard errors of the coefficients.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The credit terms existing in 1951--the last full year of regulated instalment credit--were substituted for those of 1955, and the effects on consumer spending and debt are noted. It was found that if tighter regulated terms had been enforced in 1955, consumer spending for durables would have been $5.3 billion, or 16 per cent less. Instalment credit granted would have fallen by 29 per cent or $11.3 billion, and instalment credit outstanding instead of increasing by $5.5 billion would have fallen by $.7 billion.

As a result of these operations, attention is directed to the potential economy-wide effects of Regulation W. The study suggests that unless the monetary authority can freeze funds released from the instalment credit market in idle balances, or offset them by reducing the money supply, the deflationary effects of reduced consumer spending could conceivably be more than offset by increased spending on the part of other borrowers. Therefore, since the effectiveness of Regulation W requires accompanying general monetary controls, the necessity of such a special control at all is questioned.

134 pages. $2.00. Mic 58-4147

ECONOMICS, HISTORY

AN ECONOMIC HISTORY OF IDAHO TERRITORY, 1863-1890

(Publication No. 25,112)

August Constantino Bolino, Ph.D.
St. Louis University, 1957

This study attempts to do two things: first it describes the economic development of Idaho Territory, and secondly it applies the descriptive material to test a theory of history — that economic regions like national economies develop in stages.

The first nine chapters of the dissertation are arranged so as to clearly indicate the progression of Idaho's economy from isolated independent settlements to a state dependent on specialization, transportation and economic intercourse within the framework of a capitalistic system. It is shown that until 1860 Idaho was largely an uninhabited region. The discovery of gold stimulated immigration, developed new towns, fostered new enterprises and brought outside capital into Idaho.

As mining showed spectacular results, other industries became economically profitable. The transportation, livestocking, and farming industries grew up to service the needs of miners. Agriculture provided the foundation for economic permanency. As capital importation increased, there was an increasing tendency toward concentration. The combination movement was also felt in livestocking. Ranchers were compelled to rationalize as land became scarcer due to homesteading.

One of the chief roles of mining was its effect on transportation. The Utah and Northern and the Oregon Short Line Railroads hastened economic evolution, expanded markets, created new demand for goods, stimulated immigration and increased the importance of financial institutions. New business created a demand for money, and increased urbanization added to the demands on government.

As the corporation became the dominant form of organization, employment was steadier and the wage inched up very slowly. But class conflict became the rule and in labor there was a "heritage of conflict."

In testing the theory of stages, the views of two genetic economic historians were used: those of Friedrich List and Werner Sombart. List assumed that regions with sufficient territory, an abundance of raw materials, and economic independence would "normally" progress from collectional economy, to pastoral, agricultural, agricultural-manufacturing and agricultural-manufacturing-commercial exonomies. It was dound that although the Indians were collectional and nomadic, the white men were not unless these concepts are defined in a somewhat broader sense. List's analysis did not apply to a territory where civilized men occupied a wilderness inhabited by uncivilized Indians.

Werner Sombart writing in a later period developed a theory of stages for a capitalistic economy: from the mercantile phase to the industrial and financial phases. The theory was found insufficient to explain Idaho's development because: (1) the merchant class which developed in Idaho was not very distinct and did not control the Idaho economy, (2) there never was a fully developed industrial phase, and (3) although banks became more important and finance capitalists did influence Idaho, it is uncertain that finance capitalists ever controlled much of Idaho's industries.

In conclusion, it was stated that in assessing the theory of stages, List was found somewhat wanting and Sombart was insufficient. A variation of the genetic approach was offered which stressed the mining frontier as a starting point and which led to the ranching and farming frontiers, aided by favorable land laws and a rapidly increasing immigration.

The theories of Norman Gras were presented to substantiate the claim that stages are tentative and not final, and that they should be altered as new evidence is made available. But this view is not held by some genetic economic historians, such as Professor Ischboldin, who feel that the theory of stages is fundamentally sound and that only some modifications or eventually additions must be made to account for evolutionary changes. For them there is quite an analogy between the Listian analysis and the development of the American West.

436 pages. $5.55. Mic 58-4148

THE DEVELOPMENT OF A MARKET ECONOMY IN TEXAS, THE ESTABLISHMENT OF THE RAILWAY NETWORK, 1836-1890

(Publication No. 25,182)

Harry Williams, Jr., Ph.D.
The University of Texas, 1957

Supervisor: Professor Ruth A. Allen

This study focuses attention on significant features of an underdeveloped area undergoing a pervading innovational

disturbance. The concern is with the impacts of railways as they were built into the interior from the port cities and cross laced into a railway network. The actual construction of the lines is of some concern, but attention is mainly focused on economic impacts, population growth, financial structures, and public aid policies.

The construction of the railway net in Texas in the nineteenth century wrought profound structural and institutional change in the economy of the area. Prior to the building of the railways, the region was a disconnected, almost completely isolated agricultural economy. Commodity and population movement was expensive and uncertain. The single most outstanding feature of the economic landscape was immobility of factors of production. Trading activities were widely scattered and organized market structures were few. Organized, intricately concatenated trading activities can occur on a widespread scale only under institutional patterns known as market structures. Such regularized and informed activity must have both a physical base and an institutional superstructure. The thesis presented here is that the physical structure required for organized commercial activity is an adequate system of transportation. From its initiation to maturity, it is the transportation network that shapes, locates and makes possible the transformation of an underdeveloped region into a commercial economy. A commercialized economic order is built around market structures that are impossible in an ox-wagon, mud-bound region pervaded by uncertainty and irregularity of movement. It appears demonstrable that such an underdeveloped area must rely on more mature regions for physical and financial aid in structuring its economic overhead.

Economic development occurs much more rapidly in underdeveloped regions than it would otherwise if it begins with an accumulated base of skills and equipment found in already existing mature areas. Even so, a new innovation requires a period of gestation, inasmuch as it shatters existing economic relationships and will meet resistance from vested interests in physical and institutional relationships.

A further theme pursued throughout this study is the question of whether private or public efforts contribute most to the building of economic overhead facilities. The data and correlative information indicate clearly that private enterprise alone would have been much slower in construction of the railway net in Texas.

Still another thesis presented is that increasing population growth, growing land values, increased imports and exports, wider varieties of consumption and production, and increasing urbanization directly correlate with railway development.

Finally, an attempt has been made to demonstrate that commercialization, urbanization, and resulting specialization lay the groundwork for subsequent industrialization. Industrialization builds on surpluses of labor, commodities, and skills, all of which are generated out of an environmental area that has been wracked with innovational disturbances and transformed from a mass of rural entities to an integrated and commercialized market unit.

512 pages. $6.50. Mic 58-4149

ECONOMICS, THEORY

THE UNITED MINE WORKERS: A STUDY ON HOW TRADE UNION POLICY RELATES TO TECHNOLOGICAL CHANGE

(Publication No. 24,312)

Stanley Miller, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor L. Reed Tripp

There seems to be a gap in the existing literature in terms of a formal structuring of the determinants of conscious union policy. Through a study of the historical position which the United Mine Workers of America has taken in meeting technological change, I hope to not only show the development of the UMWA's position, but to suggest a working hypothesis of general determinants which may be influential in the resolution of any given union's position towards technological change.

On the basis of the early history of the UMWA and the experiences of its leaders, Lewis fashioned an early stabilization program, the Jacksonville philosophy, which he believed would lead to stable conditions in the coal industry by removing the surplus men and mines.

The key features of this program included these points: 1. The UMWA should actively encourage the mechanization of coal operations. 2. The freight rate structure should be corrected for distance and area inequities, and an adequate freight car supply should be secured. 3. The use of the pick-machine rate differential should be discontinued. A time payment for miners should be substituted for the piece or tonnage payments. 4. The powers of the national union should be strengthened at the expense of the local union. 5. The concern over social costs should be removed from the union's jurisdiction. 6. The UMWA should attempt to organize all the miners. 7. Government should guarantee certain basic conditions, and act as overseer over the coal industry.

The Jacksonville program failed not because its features were unsound, but they proved inadequate in face of secular and cyclical forces. Lewis reorientated his thinking in the direction of a more workable policy.

The second phase of Lewis' stabilization efforts minimized the abilities of the operators, and the UMWA assumed a more forceful role. Three new features were added to Lewis' earlier program. 1. A competitive fuels policy for the industry was to be fostered. 2. Greater emphasis was to be placed upon sound marketing policies. 3. In stress situations the government should assume a greater role in the industry and institute controls and regulations.

The union at this time assumed the role of ordering the industry. The factors which led the union to this position can be divided into:

1. Factors indigenous to the union institution: A. The quality of union leadership. B. The allegiance and espirit de corps of the union members. C. The degree of control exercised by the national. D. The psychology of the union and the ethic of its leaders. E. The strength and power of the union.
2. Factors indigenous to operations and to the operator: A. The ratio of wage cost to total costs.

B. The lack of leadership by the coal operators. C. The necessity for countervailing power against the large coal consumers. D. The cut-throat competitive conditions existing in the industry.

3. Factors relating to the supply of labor: A. Non-union competition. B. An oversupply of miners. C. The opportunity cost of the displaced miners was often higher than returns under part-time employment.
4. The technological factors: A. The rate and extent of technological change was limited by the physical conditions of the mine.
5. Factors influencing the demand for the product: A. The secular decline in the demand for coal. B. The elasticity of demand.
6. The role which government and the general social environment has played: A. The attitude and position of the I.C.C. and other investigatory bodies towards the problems of the coal industry. B. The experience of the union with governmental intervention. C. The extent to which government will care for the social costs resulting from mechanization.

These six general factors emerge as the general determinants which may be influential in determining a union's position towards technological change. Any evaluation or study of the union's relation to change which ignores the relevancy of each facet will result in a limited approach to the problem. 229 pages. $3.00. Mic 58-4150

CANADA'S POST-WAR BALANCE OF PAYMENTS ADJUSTMENTS 1946-1954

(Publication No. 25,263)

Ernest William Ogram, Jr., Ph.D.
University of Illinois, 1957

In general terms this thesis is a study of Canada's balance of payments position in the post-war period. In 1946 Canadian loans and export credits to the countries of Western Europe amounted to nearly $2 billion. The primary objective of this study was to analyze the adjustment process resulting from this outflow of capital and the subsequent inflows in the early 1950's. Three theories are considered. The Classical and Keynesian explanations of the mechanism of adjustment were rejected on the grounds that (1) the assumptions of the Classical school were not satisfied for the period under study, and (2) the Keynesian model did not adequately explain the period under consideration. The mutual interdependency theory in which all variables are simultaneously determined within the system, was offered as the most satisfactory approach to the adjustment process for the 1946-1954 period. A mathematical model was presented to illustrate the mechanism of adjustment under the simultaneous equations approach. The world was divided into three regions, Canada the United States and the rest of the world. The latter was defined to include only the OEEC countries. The major hypothesis contained in the model can be stated in two parts. First, imports to the OEEC countries in the 1946-1950 period were not in proportion to OEEC income but were in proportion to what might be called the international financial potential of the OEEC area. The latter was composed of (1) autonomous lending by Canada and the United States to the OEEC countries and (2) the foreign exchange provided by exporting to Canada and the United States. Second, OEEC imports in 1951-1954 period were in proportion to OEEC income.

The above hypothesis was tested empirically by processing a multiple correlation program through the digital computer. The results of the correlation tended to substantiate the hypothesis.

Certain parameter estimates were also made to demonstrate the usefulness of the model for a particular type of balance of payments problem, i.e., the increasing or decreasing independence or dependence of one country for the exports of another. These estimates were for specific import propensities compared to the more general estimate found in most of the literature today.

A secondary objective of this study was to assess the importance of United States commercial policy on Canada's balance of payments. A hypothetical reduction in the United States tariff on manufactures is assumed along with an imperfectly competitive market. This is followed by an analysis of both the immediate and long-run effects of such a reduction on Canada's balance of payments. The discussion of the immediate effects demonstrated that the greatest possible reduction in Canada's trade balance deficit with the United States would result from (1) a highly elastic demand curve facing the Canadian producer, (2) a negatively sloped Marginal Cost curve and (3) no retaliatory action on the part of U.S. producers of domestic substitutes. It was pointed out that even under the most adverse conditions, i.e., low demand elasticity, increasing costs and full retaliatory action by domestic producers, some positive reduction in Canada's trade balance deficit with the United States will take place. The only exception would occur when U.S. domestic producers of identical substitutes immediately cut prices by the full amount of the reduction in the duty. Finally, in discussing the long-run effects it was pointed out that there need be no adverse repercussions on U.S. income and employment as a result of a gradual reduction of U.S. import duties. To ease the adjustment problem for affected firms a concerted effort on the part of domestic producers, local, state and federal agencies could prevent a decline in U.S. income and employment. This in the long run would result in a net improvement in Canada's trade balance deficit with the United States.

226 pages. $2.95. Mic 58-4151

EDUCATION, GENERAL

HONORS PROGRAMS IN CATHOLIC COLLEGES OF THE NORTH CENTRAL ASSOCIATION

(Publication No. 25,110)

Sister Mary Matilda Adams, O.S.F., Ph.D.
St. Louis University, 1957

This study sought to discover the prevalence of honors programs in the fifty-eight Catholic colleges and universities of the North Central Association of Colleges and Secondary Schools, to examine the general features of the programs which have been established, to ascertain the extent to which students are taking advantage of these programs, and to consider the practice in this select group of colleges against the background of theory and practice in other American schools, as seen in the literature on the subject during the past thirty years.

Official publications of the respective colleges, questionnaires returned by the academic deans, and personal interviews with individuals associated with the various programs were the sources of data. In the light of these data, recommendations and selected areas for further study were proposed.

Only nine colleges qualified for inclusion in the study proper. Two hundred twenty-two students, a very small proportion of the total student body, were found enrolled in honors. This number included proportionally fewer women than men. Only two schools directly recruit students for their honors programs. Each college makes a more or less systematic effort to identify students already enrolled, who should be encouraged to go into honors.

For the most part, honors students follow the regular curriculum, but in separate class sections where this is feasible, except for a special course or sequence of courses designed especially for honors students. This course sequence, which is regarded, in some instances, as the "core of the honors" program, is variously designated as "Honors Reading," "Honors Lecture," "Great Books," and "Honors Minor."

In most colleges, the department in which a student elects to major provides individual help, the amount varying greatly among colleges and among the departments within each college. The number of departments which provide private direction for honors students varies from four in several schools to twelve in one of the university colleges.

Fitness for graduation from these programs is determined, in part, by a comprehensive examination, covering the student's field of concentration, varying in length of time from four to eighteen hours. Six colleges also require an oral examination, ranging in length from twenty minutes to two hours. An honors degree or some other special recognition is given to honors students at graduation.

The investigator concludes that little is being done for superior students in the Catholic colleges in the area surveyed, if one may judge from the small number of honors programs and the few participants in most of them. In general, the small colleges in the present study have apparently not found their honors programs satisfactory.

The author points up several serious weaknesses in the functioning programs, namely, that too many of them are limited to one or a few departments and that only a relatively small portion of the student's time is devoted to strictly honors courses, or spent in special class sections in which the teaching is geared to superior students.

Among the areas recommended for further study are: a more thorough investigation of the entire content of existing honors programs and a study of ways and means of adapting the idea of an honors program to a small college and especially to colleges for women.

233 pages. $3.05. Mic 58-4152

AN INQUIRY INTO TEACHER AND SUPERIOR PUPIL PERCEPTIONS OF BRIGHTNESS ROLES

(Publication No. 25,327)

Charles Norman Cramer, Ed.D.
University of Maryland, 1957

Supervisor: Professor Kenneth O. Hovet

This study is essentially an inquiry into those behavior patterns of pupils which enable pupils to be identified as superior in a selected high school situation. The study has these objectives:

A. With respect to teacher perceptions

1. to determine which behavior roles are perceived as characteristic of superior students, and,
2. to compare teacher perceptions of "brightness" with results of standardized tests.

B. With respect to superior pupil perceptions

1. to determine which behavior roles are perceived as necessary for being identified as bright, and,
2. to compare the roles played with the reactions of the students toward them.

A superior student was defined as one with I.Q. 120 or above on the Otis Self-Administering Test of Mental Ability, Form A, and at least two years above grade in paragraph comprehension or word meaning on the Stanford Achievement Test, Form K.

Eighty-six teachers listed behavior patterns of superior pupils whom they taught. Each teacher named three superior pupils.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The 727 behavior patterns reported by teachers were translated into a "things-to-do" questionnaire of 102 items or roles of brightness necessary for pupils to win recognition for outstanding accomplishment. This instrument was administered to 114 "bright" seniors who checked the 102 items 5401 times.

The bright pupils were divided into three groups for data analysis and interpretation: Teacher Nomination Only, Master List and Combined List.

Spearman-Brown rank correlations were established between the three senior groups' responses and responses from the teacher group.

Presentation of data and results were organized under headings indicated in objectives listed above.

The teachers seemed to perceive brightness roles in terms of characteristics reported in the literature. Responses tended to fall in the emotional, social and intellectual areas rather than physical areas. Conformity and academic achievement tend to be reported as characteristics of superiority. Extra work by students was the most commonly recognized criterion of superiority. The teachers' nominations of pupils as superior were 45 percent in agreement with the results of standardized tests. Teachers in language, mathematics, social studies and science were in greatest agreement with results of standardized tests. Teachers in industrial arts, physical education and business education were in least agreement with results of standardized tests.

The most highly selected group of seniors had a significant positive correlation with teachers in identifying characteristics of brightness. These same pupils indicated ways of gaining recognition in this school for outstanding accomplishment and made suggestions for improvement of the school program.

There is the suggestion that the goal of admission to college is significant in brightness roles. Further, the bright pupil is able to conform and meet teacher expectation better than average pupils.

Implications are evident in curriculum building for superior pupils, more efficient identification of superior pupils, public relations, needs theory, and guidance services. 224 pages. $2.90. Mic 58-4153

THE CONTRIBUTIONS OF AFROTC AND PHYSICAL EDUCATION EXPERIENCES TO SELECTED COMPONENTS OF FITNESS OF COLLEGE MEN

(Publication No. 25,352)

William Winfred Harkness, Ed.D.
Stanford University, 1957

The Problem

The purpose of this study was to test the hypothesis that AFROTC activities including military drill and physical education have a differential effect upon physical fitness and attitudes toward physical education of college men at San Francisco State College, and to bring evidence to bear on the assumption of equivalency of contribution which appears to be implicit in the practice of substituting ROTC for physical education in secondary schools and colleges.

Procedure

The study was conducted at San Francisco State College in 1956, with matched groups of AFROTC cadets, and students enrolled in P. E. 1.1 -- Freshman Physical Education Activities.

Special questionnaires, Phillips'[1] JCR fitness test, and Wear's[2] Physical Education Attitude Scales were used to collect the data.

Results

The pre-test scores of the non-equated total groups were approximately the same although AFROTC cadets consistently demonstrated slightly lower average scores than P.E. 1.1 students or cadets also enrolled in the P.E. 1.1 program.

Significantly larger mean differences in post-test physical fitness scores were found in favor of the P.E. 1.1 students in a group of forty-five matched pairs of AFROTC 1.1 and P.E. 1.1 students (.01 level of significance), thirty-one pairs of entering freshmen (.01 level), and fourteen pairs of entering freshmen who had been matched with identical pre-test fitness scores (.03 level). Four cadets matched with four other cadets enrolled in both programs demonstrated a mean difference in favor of the cadets enrolled in the P.E. 1.1 program which was not significant (.31 level of significance).

No significant difference in attitude toward physical education was found in four groups of matched pairs of AFROTC and P.E. 1.1 students. However, the largest group of fifty-three matched pairs showed a mean difference in favor of the P.E. 1.1 students which was significant at the .07 level and although this approached the acceptable .05 level, it was not accepted as evidence of a real difference.

Questionnaire responses showed that the AFROTC 1.1 cadets and P.E. 1.1 students felt approximately the same about each aspect of the fitness testing program administered.

Conclusions

1. The hypothesis that AFROTC and physical education experiences contribute differentially to physical fitness of college men at San Francisco State has been strongly supported by the findings of this study.
2. The P.E. 1.1 program at San Francisco State College contributes significantly more than the AFROTC 1.1 program to the physical fitness of entering freshmen as well as men who may be in or above the entering freshmen level.
3. The hypothesis that physical education and AFROTC programs contribute differentially to students' attitudes toward physical education is not supported by the findings of this investigation. However, the fact that the mean difference found in favor of the P.E. 1.1 students in the group of fifty-three matched pairs of students was significant at the .07 level, which approached the acceptable .05 level of significance, indicated the advisability of testing the hypothesis again with other groups.
4. It is permissible in using the JCR physical fitness

test to match students on the basis of pre-test scores which are either identical or up to within three points of each other without materially affecting the confidence which can be placed in the mean differences found in favor of physical education.

5. The majority of AFROTC 1.1 cadets and physical education 1.1 students at San Francisco State College feel that a knowledge of one's level of physical fitness is of value, and that the testing program, used as a part of this study, was a good one, of value to them, and one which should be continued.

6. A five-item fitness test, including the JCR test, is quite acceptable to AFROTC and P.E. 1.1 students both in difficulty and in number of items, and the knowledge of one's fitness status appears to stimulate the students' interest in their fitness and motivates them to plan changes in their school programs or activity habits.

143 pages. $2.00. Mic 58-4154

1. B. E. Phillips, "The JCR Test," Research Quarterly, 18: 12-29, March, 1947.

2. C. L. Wear, "Construction of Equivalent Forms of an Attitude Scale," Research Quarterly, 16: 113-119, March, 1955.

AN INVESTIGATION OF THE EFFECTS OF CLOSED-CIRCUIT TELEVISION ON VARIOUS MEMBERS OF A SELECTED HIGH SCHOOL COMMUNITY

(Publication No. 24,906)

James Eudean Heald, Ph.D.
Northwestern University, 1957

On the opening day of the 1956-1957 school year, Evanston Township High School, Evanston, Illinois, embarked upon an experiment designed to determine the possibility of using closed-circuit television as an instructional medium. The project was an attempt to test the ability of the medium to better utilize the skills of capable teachers by extending those skills to a large number of students in viewing rooms supervised by classroom aides. While the first year of the experiment was used to determine the merits of adapting two courses (Senior Beginning Typewriting and 2 English-Speech -- a combined course for sophomores) to television, this specific research was designed to measure some effects of the medium on various members of the high school community. The experiment itself had been approved by the Commission on the Experimental Study of the Utilization of the Staff in the Secondary School (N.A.S.S.P.) and was sponsored in part by the Ford Foundation's Fund for the Advancement of Education.

An attempt was made to measure some of the effects of using television upon the attitudes and achievement of students, upon the work load and mental health of the teachers, upon the role and attitudes of the classroom aides (predominantly student teachers), upon the feelings and attitudes of the parents, and indirectly upon the taxpayers of the community who bore the major portion of the project expenses. Data were gathered from recorded interviews, personal observations, primary and secondary school records, and through the employment of various questionnaires.

The normal personnel relationships of the students in the typing experiment, who had practically no personal contact with the instructor, were disrupted much more than the same relationships of the English-Speech students. These latter students enjoyed a much closer relationship (through class rotation and periodic interviews) with the teacher. Few students, from either course, felt that the change in relationships was detrimental to the learning environment. Other effects noted upon students were (1) changes in the kinds of responsibilities demanded of them, (2) greater demands for the use of discriminatory powers in interpreting televised instruction, and (3) a desirable quantitative increase in the necessity for reliance upon self. In the area of pupil achievement, typing students were found, by statistical analysis, to have achieved just as well as non-television taught students. Research concerning pupil achievement in English-Speech was undertaken by another investigator and was not included in this particular research.

The greatest effect felt by the television teachers arose from the necessity to project and extend their techniques to educate students in remote areas. Feelings of insecurity aroused by the introduction of the new environment gradually diminished as the teachers became more familiar with the demands of the electronic equipment.

Student teachers, serving as classroom aides in the remote rooms of the English-Speech experiment, felt concern over the difficulties involved in finding enough time to schedule lessons. Their tasks, concerned with classroom supervision, left little time for the lesson preparation.

About one-fourth of the parents of students in the experiment expressed a felt concern when they learned that their children had been placed in an experimental classroom. Their greatest concern centered around a possible loss of teacher contact and a fear that classroom supervision would suffer from the use of television.

Many questions were left unanswered by this case study, and many others were deferred by the high school staff. Experimentation and evaluation were scheduled to continue on a much greater scale in subsequent years because of the desire of the Evanston school to continue with such educational experimentation.

232 pages. $3.00. Mic 58-4155

THE DEVELOPMENT OF THE IN-SERVICE STUDY ACTIVITIES PROGRAM OF THE BALTIMORE PUBLIC SCHOOLS

(Publication No. 25,332)

Kenneth G. Horvath, Ed.D.
University of Maryland, 1957

Supervisor: Professor Alvin W. Schindler

The purpose of this study was to present a description and an analysis of the system-wide in-service activities program as it was developed in the Baltimore Public Schools since 1946. In order to fulfill this objective the writer collected materials: (1) to indicate briefly the

nature and scope of in-service education in the Baltimore Public Schools before the Professional Development Committee was organized; (2) to describe the nature and scope of the program which was initiated and carried forward in 1946; (3) to give an account of the changes made in bringing about a shift from administrative to school staff planning and implementation of the program; and (4) to present recent changes and developments.

Through the use of secondary sources, background information was introduced to reveal how some of the older and more widely practiced activities originated. Also, current practices of in-service education in the United States, as revealed in two studies, were summarized. Although evaluation was not a major purpose, data presented in the study were related to criteria considered basic to an enlightened program of continuous professional development.

The Committee on Professional Development of the Baltimore City Public Schools was organized by the Superintendent in the summer of 1946. During the formative period (1946-50) the Professional Development Committee established procedures in helping teachers obtain guidance and information, clarified the relationship between professional in-service activities and university extension courses, planned for the improvement of leadership within groups, encouraged activities having system-wide application, developed ways of identifying and selecting members of the system for service on committees, devised ways of evaluating educational services, planned in-service activities for personnel other than teachers, and provided special activities to meet the varying interests and needs of all personnel.

After the first reorganization (1950), the Professional Development Committee shared its work with the newly organized divisional committees. It furnished guidance to divisional committees, gave encouragement to activities having system-wide application, developed methods of accrediting all in-service offerings, studied ways of more equitably allocating professional development funds, made available opportunities for noncredit activities, and provided for continuous evaluation of the professional development program.

Under the most recent reorganization (1954), the Professional Development Committee functions as a central coordinating agent, serving in an advisory capacity to divisional committees which have wider potentialities in the area of professional development. The Central Committee makes suggestions to the Board of Superintendents regarding policies, procedures, and objectives of in-service study activities.

The evolution of the Committee on Professional Development has afforded an interesting example of application of democratic principles and procedures in the development of staff in a large city school system. The data indicated that those responsible for the program of professional development, functioning as a group, (2) studied, analyzed, and discussed the professional development needs and interests of the entire system, (b) recommended action steps to the Board of Superintendents, (c) administered approved action steps through assigned individual members, and (d) broadened the scope and effectiveness in organizing sub-committees of personnel from all areas and departments of the school system. The program had the benefit of continuous suggestions from thousands of teachers and from evaluations made by sponsors and participants alike. 348 pages. $4.45. Mic 58-4156

A SCHOOL CUSTODIAL TRAINING PROGRAM FOR THE STATE OF OHIO

(Publication No. 24,079)

Harold Leroy Nichols, Ph.D.
The Ohio State University, 1952

The over-all problem of the study is to formulate a plan for a state-wide custodial training program that will improve the selection, qualifications, and in-service education of custodians employed in the schools of Ohio and eventually lead to state-wide certification of all such employees.

The purposes of the study are to emphasize the tremendous importance of the school custodian in the total educational program of the modern school; to show the economies that may be effected through the use of qualified personnel; to determine the need for, and interest in, a school custodial training program; to ascertain the extent and characteristics of existing custodial training programs in the United States; to develop criteria that should govern the establishment of a functional custodial training program in the state; and to formulate a plan of state-wide school custodial training for Ohio based on practical principles.

The importance of the position held by the school custodians partially justifies the study. The custodian, who formerly did comparatively simple non-skilled work, now performs skilled and technical services in such an unobtrusive manner that school authorities and the lay public are as yet only partially aware of the change. Womrath says the modern school custodian must be:

1. An economist with ability to save on the use of supplies and equipment.
2. A sanitarian with proper appreciation of the contribution of cleanliness and sanitation to the health and comfort of children.
3. A sociologist with a clear conception of his school relationships with principals, teachers, children, parents, and the community.
4. A moralist with a keen sense of what constitutes right and wrong conduct and behavior so that he may assist in developing proper school attitudes and discipline.
5. An exemplar who by his deportment, disposition, character, personal appearance, patience, honesty, kindliness, and forbearance should set an example for right conduct which will be an influence for good in the lives of children.
6. A diplomat, shrewd and tactful in his contacts with children, other employees and the public.
7. An expert housekeeper who by example establishes standards of right domestic living in the school home.
8. A safety engineer familiar with the causes of accidents and their remedy.
9. An expert mechanical engineer with adequate knowledge of heating plants, plumbing and sanitary equipment, ventilation and air conditioning.[1]

The American public school, one of the greatest contributors to the cultural and economic advancement of the

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United States, has constantly extolled the virtues and values of education. Paradoxically, in general, it has sought its custodial employees from the ranks of the poorly educated. Furthermore, very little has been done to prepare the school custodian to meet the tremendous responsibilities and rigorous qualifications required by the position. With the exception of a few large cities, only a relatively small number of the 85,000 school districts in the United States are making provisions for training school custodians. Garber says:

> There is probably no other governmental position of equal responsibility filled by appointees so entirely lacking in technical training and oversight as in the case of school janitors. As a consequence, most of our school janitor service is haphazard.[2]

Two lines of investigation have been pursued in the study. First of all, a thorough research was made into the literature bearing on the subject. Sources of data were books, periodicals, school survey reports, rules and regulations of boards of education, guides and courses of study for existing custodial training programs, interviews, personal observations, and questionnaires.

In an effort to ascertain the current status, characteristics, and content of custodial training programs in the United States, five different questionnaires were used.

A preliminary postal card questionnaire was sent to all cities in the United States having a population of over 50,000 in 1950, inquiring about the existence of formal custodial training programs. A total of 228 city school districts received questionnaires, and responses were received from 126, or 55 per cent. Fifty-two of the 126 city school districts indicated that organized custodial training programs were in operation. An analysis of these programs revealed that 29 provided three days or more of organized training per year. A more detailed questionnaire was then sent to these 29, inquiring about the organization and operation of the custodial training program. Responses to this questionnaire numbered 16, or 55 per cent.

A questionnaire was sent to the 48 State Vocational Education divisions to ascertain to what extent custodial training schools were being sponsored by them and to determine the nature of the training program. Thirty-seven responses were received, and 25 states indicated that they were participating in custodial training programs. A fourth questionnaire was sent to 5 selected colleges and universities known to be sponsoring custodial training programs in an effort to determine the characteristics of their training schools, and answers were received from each school.

In addition, questionnaires were sent to all Ohio city, exempted village, and 100 local school administrative heads, totaling 300. Answers were received from 217, or 72 per cent. The twofold purpose of this questionnaire was to determine the present status of school custodians in terms of number, age, tenure, formal education, and welfare status, and to ascertain the opinions of school administrators concerning the importance of custodial services and to what degree they were interested in such programs.

Answers from school administrators in Ohio concerning the importance of the custodian indicate that the majority recognize his potential role in fostering good public, staff, and pupil relations and high moral standards, and his important contribution to health, safety, maintenance, and the economical use of school supplies and equipment. On the other hand, there were several who indicated that his responsibilities should still be limited to sweeping floors and firing furnaces. There is some indication also that the public in general is not aware of the importance of the custodian.

Responses to questions which sought school administrators' opinions concerning their satisfaction with custodial staffs in meeting various responsibilities show that there is certainly room for improvement.

Data concerning age, formal education, and tenure were received from 2,200 of the 6,500 school custodians in Ohio. The median age in Ohio is approximately 51 years. Local school districts employ younger men, in general, than do city and exempted village school districts. School custodians in Ohio have more formal education than the average adult in the state. Eighty-one and seven-tenths per cent of the school custodians have completed the eighth grade; 28.4 per cent have attended high school; 23.8 per cent have completed high school, and 2.1 per cent have attended or completed college. There is a large turnover of school custodians; approximately 45 per cent are new to their positions every five years.

Before formulating a proposed custodial training program for the state of Ohio, the writer deemed it wise to ascertain how much interest school administrators, custodians, and other persons and agencies concerned had in such a program. Almost 75 per cent of the school administrators indicated they would favor a state-wide plan of custodial training. Custodians and members of boards of education, the State Department of Education, and the lay public were also favorable to such program. Fifty-one per cent of the school administrators thought the program should be elective, and the remainder believed it should be mandatory.

Opinions of the same groups of persons concerning certification of school custodians revealed less enthusiasm, although the majority were favorable. A restraining factor in certification results from the fact that the public schools cannot compete with industry in obtaining desirable custodial employees at the present time.

Agents and agencies influencing early emphasis on custodial services included the National Education Association, the National Association of Public School Business Officials, the United States Office of Education, hygienists and health agencies, city superintendents, and professional observers and critics of school surveys. These agents and agencies did not conduct custodial training programs but were instrumental in influencing the establishment of training programs. Organizations sponsoring custodial training at the present time include boards of education, divisions of vocational education of the various state departments of education, colleges and universities, civil service commissions, and labor unions. The first three organizations are the most active. Fifty-two of 126 responding city school districts having populations over 50,000 indicate they are offering organized custodial training programs. Formal programs are becoming more and more prominent in large city districts. Twelve report that the program has started within the last five years, and three cities indicate they are planning to inaugurate a program in 1952.

Methods used to improve custodial services other than formal training classes in large cities include on-the-job

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supervision, apprenticeship training, and informal conferences. Considering all reported methods, 65 per cent of the cities having populations over 50,000 are making some type of effort to improve custodial services.

Twenty-five responding State Vocational Education Divisions in the United States are sponsoring, or helping to sponsor, 288 custodial training programs in their respective states. Fifth of these programs are directed by the Vocational Education Division, 231 are operated on a local basis with co-operation from Vocational Education Divisions, and seven are operated by colleges or universities with co-operation from Vocational Education Divisions. Custodial training programs are more numerous in states, such as Colorado, Kansas, and Michigan, in which vocational education departments are actively promoting the program.

Approximately twenty colleges and universities are sponsoring custodial training programs throughout the United States. The schools are usually conducted during the summer months. Courses common to all custodial training programs are sanitation and housekeeping, heating and ventilating, building repair and maintenance, and the care and operation of mechanical equipment. Most programs emphasize the operational tasks and technical skills to be performed by custodians; however, in several instances stress is being placed on the problem of human relations.

The prevailing practice in the United States is toward organizing custodial training schools on the basis of short-term units. Units of training pertinent to the needs of custodians are being taught in short extensive courses. In general, no attempt is made to cover the whole range of custodial services at one time.

Methods of instruction in most locally conducted custodial training programs include discussion-demonstration, demonstration, and job participation. Lecture, conference, general discussion, and discussion-demonstration are the usual methods of instruction in area and state programs. "To learn to do by doing under informed direction" is becoming generally accepted as the most effective instructional method.

One of the best instructors, and one of the most widely used, is the experienced custodian. In large city school districts, 63 per cent of the instructors are chosen from the ranks. Administrative personnel and outside specialists are other common sources of instructors.

Approximately one-half of the large city school districts sponsoring custodial training programs are financed through local funds; one-half receive financial assistance from federal and state funds through the vocational education program. Custodial training programs directed by the Trade and Industrial Education Service of the Vocational Education Divisions in the respective states are financed entirely from vocational education funds. Custodial training programs sponsored co-operatively by local schools and the Division of Vocational Education are usually financed on a matching basis. In most cases matching is on a fifty-fifty basis. College- and university-sponsored programs are usually financed by charging enrollment fees.

The value of custodial training has been proved wherever tried. Staff, public, and pupil relations, housekeeping, have improved health and safety standards, and morale. Economies have been noted in the use of school supplies and equipment and in the care and maintenance of school buildings.

The need for custodial training in Ohio, as summarized from answers to questionnaires, interviews, and personal observation, arises from the following circumstances: custodians are rarely employed because of special ability in custodial work or knowledge of health and safety needs; specific duties of the custodian are not known by the worker himself or—very fully—by the school administrators; administrators, in general, lack the experience or training to supervise custodians adequately; many duties are of a technical nature that require special knowledge and skill for their performance; many routine duties are performed inefficiently; the custodial turnover has been so rapid that almost one-half the men are inexperienced; less than one-fourth of Ohio schools are conducting in-service education programs for school custodians; the custodial training school sponsored by the Bureau of Educational Research of the Ohio State University enrolls less than six per cent of the total number of school custodians each year, and there is little promise of permanency or continuity in the program.

Many states are making greater effort to improve custodial services than is the state of Ohio. The worth of custodial training programs as a means of improving custodial services has been proved wherever they have been tried.

After a review of the literature and an analysis of questionnaires, the seventeen following principles or criteria for organizing a custodial training program for the state of Ohio were developed:

1. The need for a state-wide custodial training program should be determined and verified.
2. The interest in, and desire for, a state-wide program on the part of those concerned should be determined.
3. The purposes of a state-wide program should be clearly defined.
4. Custodial training should be directed, encouraged, promoted, and co-ordinated by a state agency.
5. The organization of a state-wide program should be definitely outlined to avoid instability in the conduct and operation of the program under changing administrations.
6. A state-wide program should provide an adequate staff for the efficient administration and operation of a custodial training program.
7. A state-wide program should provide for state-local participation as well as for helpful working relations with other interested agencies.
8. A state-wide program should be financed from both state and local sources.
9. A state-wide program should provide for area and state custodial training as well as on-the-job instruction.
10. A state-wide program should provide for area schools organized in short-term units.
11. A state-wide program should make an analysis of the duties and responsibilities of custodians to establish standards and units of study.
12. A state-wide program should set standards for the

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establishment of area training centers in terms of suitable housing and equipment facilities and in terms of convenient locations.

13. A state-wide program should set standards concerning class sizes and eligibility of enrollees.
14. A state-wide program should provide qualified instructors.
15. A state-wide program should be so organized that it may prepare for certification.
16. During the initiatory period, custodial training should be elective. Ultimately, it should be compulsory.
17. A state-wide training program should provide means of self-evaluation in order that it may efficiently accomplish the purpose for which it was instituted.

In addition to the seventeen principles applicable to the organization of a state-wide custodial training propram, fourteen principles governing the conduct of custodial classes are also presented.

In view of the above principles, the following proposals for the formulation of a state-wide organization to conduct a school custodial training program in Ohio are offered for the consideration of school authorities.

1. That the Division of Vocational Education of the State Department of Education of Ohio, through its Trade and Industrial Education Service shall act as the state agency vested with the responsibility of encouraging, promoting, planning, organizing, directing, and co-ordinating the state-wide custodial training program in Ohio.
2. That the Trade and Industrial Education Service of the Division of Vocational Education shall make contracts with the College of Education of the Ohio State University and other publically supported teacher training institutions whereby custodial training programs shall be promoted, encouraged, and operated.
3. That a specialist in school plant management be employed jointly by the College of Education of the Ohio State University and the State Division of Vocational Education to administer, direct, encourage, promote, and co-ordinate the state-wide custodial training program in Ohio.
4. That a state-wide advisory committee composed of representatives from school administrators; the Ohio Association of Public School Employees, the Ohio Department of Health, and related industrial and supply concerns be formed to advise in the planning of a custodial training program and to co-operate in its operation.
5. That custodial training be established on an area and state basis, as well as on an on-the-job training basis, and that public school officials in whose schools training centers are established be responsible for administering the program.
6. That the state-wide custodial training program be financed by federal, state, and local funds.
7. That the same general policies and standards relative to eligibility of enrollees, class size, housing and equipment facilities, location of classes, time schedules, length of courses, character and content of courses, methods of instruction, selection and training of instructors, and methods of reporting be used as those developed in the Ohio Plan of Trade and Industrial Education Service.[3]

In the light of analyses of the foregoing data, the following recommendations are made:

1. It is recommended that school superintendents, business managers, custodians, and/or other interested agencies, through their official organizations, enlist the active participation of the Trade and Industrial Education Service of the Division of Vocational Education of the State Department of Education in the inauguration of a plan for a state-wide custodial training program as proposed by this study, or in the inauguration of a suitable substitute.
2. It is recommended that once the decision is reached to include an organized custodial training program as a definite objective of the Trade and Industrial Education Service, provisions be made to finance the program.
3. It is recommended that necessary legislative proposals which provide for the certification of school custodians be prepared by the superintendent of public instruction and presented to the State Legislature, and that one of the prerequisites for certification be the completion of recognized training.
4. It is recommended that further research be conducted to determine specifically the policies of boards of education concerning selection, salary schedules, tenure, retirement, sick leave, and working conditions of school custodians in Ohio.
5. It is recommended that continued efforts be made by school authorities to emphasize the importance of the school custodian in the modern school educational program.
6. It is recommended that proposals herein submitted relative to school custodians be expanded to include the training of all non-teaching personnel in the public school system, such as bus drivers, cafeteria workers, and clerks of boards of education.

304 pages. $3.90. Mic 58-4157

1. Womrath, George F. Efficient Business Administration of Public Schools. Milwaukee: Bruce Publishing Company, 1932, pp. 279-81.

2. Garber, J.A. The School Janitor. Washington, D.C.: Government Printing Office, 1922. (Bulletin No. 22, United States Bureau of Education), p. 20.

3. "The Ohio Plan of Trade and Industrial Education." Columbus, Ohio: Division of Vocational Education, State Department of Education, 1948, pp. 82-90.

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TEACHER SELF-ACCEPTANCE RELATED TO ACCEPTANCE-OF-PUPILS IN THE CLASSROOM

(Publication No. 25,336)

Leonard A. Ravitz, Ed.D.
University of Maryland, 1957

Supervisor: Dr. Hugh Gerthon Morgan

The purpose of this study was to investigate the relationship between the self-acceptance of teachers and their acceptance-of-pupils in a classroom teaching situation.

Seventy-three public school teachers were observed with respect to verbal behavior while in the process of teaching. The primary focus of their concern, the students or themselves, as revealed by the proportion of learner-supportive to teacher-supportive statements made, was established as a measure of acceptance-of-pupils.

A semantic differential inventory, containing abstract value concepts and self-conceptions related to defined attributes of the ideal self-accepting person, was then administered to these teachers. The logic of the technique permitted the derivation of a connoted meaning for each concept, and the difference in connoted meaning between certain specified self-conceptions. Self-acceptance was operationally defined in terms of the positioning of a concept above or below the median in a semantic frame fixed by three factor components of connotative meaning, and distances above or below the median between certain selected self-conceptions within this same semantic frame.

Fourfold contingency tables were set up and each of the semantic measures was tested for independence of teacher acceptance-of-pupils. Four out of twelve concept meanings and one out of three meaning differentials reached statistical significance. The probability of this occurrence was such as to support the hypothesized relationship. The pattern of semantic consistency of those indices that approached statistical significance additionally augmented this conclusion.

The support for the existence of a relationship, however, is contingent on whether or not a logical distinction is drawn between "self-acceptance" and "self-satisfaction": viewing the former as originating in a recognition of both positive and negative aspects of oneself, and realistically accepting them as such, and the latter, as rooted in an attempt to defend one's self-worth through the maintenance of an unrealistic, idealized conception of oneself. This dis-similarity, in fact, appeared to be the characteristic that established the most fundamental contrast between the high and low teacher acceptance-of-pupil groups, when compared in terms of their semantic differentiation of the abstractions and self-conceptions used in this investigations.

The desirability, as well as practicability of developing a self-acceptance test based on a semantic differential technique is indicated. The application of the findings to problems of teacher selection, evaluation, and training are not justified unless augmented by research that would indicate whether or not the relationship between teacher self-acceptance and acceptance-of-pupils is continuous or disjunctive in character. 158 pages. $2.10. Mic 58-4158

AN EXPERIMENTAL COMPARISON OF DIRECT AND DETAILED AND DIRECTED DISCOVERY METHODS OF TEACHING MICROMETER PRINCIPLES AND SKILLS

(Publication No. 25,270)

Willis Eugene Ray, Ed.D.
University of Illinois, 1957

Experimental evidence available has not supported any one consistent set of hypotheses with regard to discovery versus direct instruction. This study was an attempt to provide additional experimental and applied research evidence as to the relative effect of directed discovery, in situations providing numerous problem solving opportunities, upon initial learning, retention, and transfer of micrometer measurement principles and skills as compared with traditional direct and detailed instruction in these situations, with three levels of intelligence.

The following hypotheses were tested:

1) There is no difference in initial learning (knowledge of specific facts and principles, ability to solve problems, and actual manipulative performance) between groups receiving Treatment A and Treatment B.
2) There is no difference in retention of material initially learned as measured one and six weeks after instruction between groups receiving Treatment A and Treatment B.
3) There is no difference in the ability to transfer effectively the knowledge acquired as measured one and six weeks after instruction between groups receiving Treatment A and Treatment B.
4) There is no interaction between the two teaching methods employed and the low, average, and high intellectual levels with regard to initial learning, retention, and transfer of learning.

A treatments x levels design was employed in this experiment. Two experimental teaching methods and one control constituted the three treatments, and the three levels were determined with reference to mental ability level assumed to be related to the criterion.

The subjects used were 117 ninth grade boys from three junior high schools. Subjects in the six experimental subgroups were given 47 minutes of instruction regarding the names and functions of the parts of the one inch vernier micrometer caliper, facts about the instrument, micrometer and vernier principles involved in reading the tool, and how to manipulate and read the tool for actual measurement. The three control subgroups were given no instruction but simply were administered the five criterion tests.

Three testing periods were used to evaluate the effectiveness of instruction. Immediately following treatment, the Initial Learning criterion test was administered. One week after instruction the Retention One Week and Transfer One Week criterion tests were given. At a period six weeks after instruction, the Retention Sex Weeks and Transfer Six Weeks criterion tests were administered.

The analysis of variance technique was used together with appropriate supplementary tests of homogeneity of variance and others. Correlational techniques and other methods employed were selected because of their adequacy in relation to the data. Based on this analysis the investigator found:

1) with regard to initial learning, that there was no statistically significant difference in achievement between those subjects receiving Treatment A or Treatment B.
2) with reference to retention, at one week, of material initially learned, that there was no statistically significant difference in retention between subjects receiving Treatment A or Treatment B.
3) with respect to retention of material initially learned as determined six weeks after instruction, that subjects taught by the directed discovery treatment retained a statistically significant greater proportion of this learning when compared to subjects instructed by the direct and detailed treatment.
4) in regard to effective application or transfer of learning as determined one week after instruction, that there was a statistically significant difference in transfer, between subjects receiving Treatment A and Treatment B, in favor of the directed discovery group.
5) in relation to transfer six weeks after instruction, that subjects taught by the directed discovery treatment were more able to apply, to a statistically significant degree, the learning acquired when compared to application made by subjects given the direct and detailed treatment.
6) in attempting to discover differential effectiveness of direct and detailed and directed discovery teaching methods with the low, average, and high intellectual levels, that there was no apparent interaction between teaching method and intellectual level. 190 pages. $2.50. Mic 58-4159

THE CULTURAL ORIENTATION OF TEACHERS AND SOME FACTORS OF TEACHER COMPETENCE

(Publication No. 25,359)

Donald Roff Thomas, Ed.D.
Stanford University, 1957

Statement of the Problem

The purpose of the study was to generate a hypothesis concerning the cultural orientation of teachers and its possible relationship to professional role expectancies and their operationally defined factors of teacher competence. Since a wide variety of definitions of a good teacher exists in education, there is implied a wide variety of standards. It was assumed that diverse standards reflect differences in value orientations, and that value orientations may be assumed to be associated with an individual's enculturation, level of acculturation, and present general status in society. It was further argued there is a behavior system and occupational type associated with teaching that is pertinent to, and in part, determines the cultural orientation of the teacher, and vice versa.

Procedures

An examination was made of pertinent literature from sociology, anthropology, and education to determine the social space of teachers. Social space was defined as the location of an individual or group in the society as measured by such coordinates as social class, occupational type and role, status, prestige group, stereotype and the resultant behavior system.

Next there was a description of three professional role expectancies and allied factors of teacher competence as defined by Measure of a Good Teacher, known as "the California definition," and nationally recognized by the National Commission on Teacher Education and Professional Standards of the National Education Association. The three professional roles not examined may have significance, but time limitations dictated selection of roles considered most pertinent to the social space of teachers. They were Mediator of the Culture, Member of the School Community, and Liaison Between School and Community.

Results

Twenty descriptive generalizations on the social space of the typical teacher were produced and compared to the professional role expectancies. The hypothesis was developed that the social space of teachers contradicted the role expectancies of the profession. Implications of this hypothesis were seen for teacher recruitment, teacher education programs, and both school organizational schemes and the role of the administrator. Secondary hypotheses were offered to the effect that future teachers needed to be selected from a wider range of the population, that teacher education programs apparently have failed to develop the competences sought for, and that present school organizational schemes and the traditional role of administrators were antithetical to the fulfillment of the role expectancies.

Conclusions

Conclusions were that (1) sufficient distance exists between the social space of teachers and professional role expectancies to warrant proposing extensive changes in teacher recruitment, teacher education programs, and school organizational schemes and administrator roles, (2) further research is necessary on teacher roles, and (3) there are signs of progress in the direction advocated by this study. Finally, it was concluded that there must be concern for these areas if there is to be increased professionalization of teaching. 118 pages. $2.00. Mic 58-4160

A COMPARATIVE STUDY OF SECONDARY EDUCATION IN INDIA AND THE UNITED STATES OF AMERICA FROM 1900 TO 1956

(Publication No. 25,181)

Antonio Mansing Vincent, Ph.D.
The University of Texas, 1957

Supervisor: Dr. Arthur H. Moehlman

The study, as the title suggests, aims at presenting a comparative appraisal of secondary education in India and the United States of America from 1900 to 1956. In the modern world, secondary education is increasingly important because of the political, sociological, scientific, and technological advances of the recent years. Thus, no country can afford to ignore the spread of secondary education. Consequently, in this study an attempt is made to compare secondary education in both India and the United

States under the following areas: Aims and Philosophy, Organization and Administration, and Curriculum and Instruction. The major emphasis in the study is on India because of the paucity of systematic studies of secondary education in India.

In the beginning, the study gives an overview of the existing system of education in India so that those who are not familiar with the system may be able to understand the setting in which secondary education in India is placed. The study also presents the history of secondary education in India and the United States in order to have better understanding of the detailed account of secondary education that is presented later. The study not only outlines the major developments in the two countries in the areas of secondary education stated above from 1900 to 1956, but it deals with the political, social, economic, and cultural forces that have tended to hold back the educational progress of India.

The study is based primarily on the survey of educational literature and especially on the reports of various commissions and committees and government documents on the progress of education published at regular intervals. It is not the aim of the study to present a statistical analysis of secondary education in the two countries, although statistical information has been provided in the study.

In the comparative analysis of secondary education and in conclusions and recommendations the writer has attempted to draw attention of interested persons to the need of improving secondary education in India by providing more multipurpose schools; by emphasizing courses in vocational education; by removing the double-tract system and the dual system of administrative control in education; by opening part-time schools; and by delegating administrative responsibility to local authorities. The study also shows the need for unifying educational efforts under the State Department of Education, for creating a single State Board of Education, for the central government taking more share in its responsibility in educational matters, and for removing the domination of external examinations. The study also analyzes the limited facilities for vocational guidance, recreational education, and agricultural education. The study also suggests that curriculum innovations and curriculum plans need to be encouraged for providing a better teaching environment, and that professional organizations need to be promoted for providing a better means of communicating educational information and supporting their implementation.

350 pages. $4.50. Mic 58-4161

PLANNING INDUSTRIAL ARTS FACILITIES FOR SECONDARY SCHOOLS

(Publication No. 25,362)

Leonard Cyril Walsh, Ed.D.
Stanford University, 1957

Purpose

The purpose of this study is to develop procedures and specifications for planning school plant facilities which are based on the curriculum and which, when applied in a given situation, will result in providing optimum shelter for the activities of industrial arts education.

It is not the intent of this study to create a plan for a facility, but rather to indicate a process which relates the activities of industrial arts directly and explicitly to facilities. Such a process does not develop "standards", but it can be used to develop educational specifications which are adaptable to changes in curriculum, building materials, and architectural treatment. There is considerable evidence to indicate the need for a study which presents relationships in such a way that they can be understood by architects and can serve as a means of communication between educator and architect in the planning of industrial arts facilities.

Process

Evolving educational specifications is the process of:

1. Describing the educational program to be housed in terms of general characteristics, activities, and equipment used.
2. Making explicit the relationships of the educational program to basic planning factors.
3. Communicating these relationships to the architect through the use of specific statements, generalizations, schematic drawings, sketches, and illustrations of facilities which have successfully provided for the relationships.

In order to develop educational specifications it was necessary to answer the following questions:

1. What is the nature of industrial arts programs?
2. What is the relationship between program and planning factors?

The following had to be known or determined to answer the questions:

1. General planning factors which serve as a basis for communication.
2. General characteristics of industrial arts programs.
3. Activities of industrial arts programs.
4. Basic equipment and materials needed for these activities.
5. Space needs and space relationships as determined by the characteristics, activities, and equipment.
6. Special services and facilities required by the industrial arts program.

The sources of data were: state curriculum guides from twenty-one states; state planning guides from eight states; a detailed survey of shop facilities in seventeen school districts, a total of fifty-five shops; supervisors of industrial arts programs; a jury of leaders in industrial arts education; and literature in the field of industrial arts and school planning.

The procedures of the study are divided into two major categories:

1. Development of educational specifications for general characteristics of the program.
2. Development of educational specifications for the major areas of instruction, i.e., general technical drawing, general woodworking, general metals, and general power-mechanics.

In Chapter V of the dissertation, the process, as developed in the preceding chapters, is applied to a specific situation as an example of how the study may be used.

Conclusions

This study has demonstrated a process that relates characteristics of industrial arts programs to basic planning factors in such a way that the program becomes the dominant influence in planning facilities.

The study can aid architects, school people, and others involved in school planning by providing a guide for planning industrial arts facilities.

The specific suggestions of space design contained in the study do not constitute a ready-made solution for any school. However, the process of relating program to facilities, as developed in the study, can be adapted to any planning problem.

The researcher recommends that additional study be made in the following areas: 1) the relationship of stated aims and objectives to the actual learning activities which are being carried on in operating programs; 2) the selection of equipment suitable for industrial arts activities; 3) requirements for college industrial arts facilities: and 4) the application of the process of developing educational specifications to other areas of instruction.

248 pages. $3.20. Mic 58-4162

POLICIES AND PRACTICES OF CURRICULUM COORDINATION WITHIN LARGE HIGH SCHOOLS

(Publication No. 24,936)

John Robert Wright, Ph.D.
Northwestern University, 1957

The Problem and Procedures

For this study, "curriculum coordination" was defined as: those personnel policies and administrative practices which are primarily directed toward integrating curriculum activities into a balanced, efficient program of development consonant with the objectives of the school.

The problem had three principal parts: (1) determination of current practices of curriculum coordination, (2) establishment of criteria, and (3) appraisal of current practices in the light of established criteria.

Current practices were investigated in two ways; by questionnaire, and by visitation of schools. Of the 232 large, independent, four-year high schools in the United States, 171, or 74 per cent, cooperated by responding to the questionnaire. Twenty schools within a radius of fifty miles from Chicago were visited to obtain more detailed information about curriculum organization and activities.

Criteria for curriculum coordination were developed by submitting a checklist of proposed criteria, drawn largely from the literature, to twenty-three cooperating curriculum specialists for their evaluations and comments. As revised to express maximum agreement among the specialists, these criteria were then postulated for the appraisal of current practices.

Principal Findings

Current practices in curriculum coordination were considered in five general areas corresponding to a logical grouping of criteria: (1) organization, (2) communication, (3) philosophy and objectives, (4) procedures, and (5) maintaining a balance of efforts.

In the course of the investigation many practices found in the schools appeared to implement specific criteria effectively. These practices were described briefly, with the suggestion that many of them might well be suitable for adaptation to other school situations.

In appraisal of current practices which related to organization of a school for curriculum work, those which appeared to meet most fully the conditions of the criteria were the provisions for specific allocations of responsibilities for coordination and for broad participation among staff members. Least well implemented were the criteria prescribing the use of democratic procedures and definitions of the roles to be played by differing groups within the community.

Communications practices effectively disseminated information from school to community, but there was a serious lack of adequate techniques for gathering information.

Few schools were found to have an adequate philosophy of education, yet very few schools were engaged in development or improvement of their philosophies.

Procedures which encouraged curriculum activity were found to be effective in causing considerable curriculum revision. However, the imbalance among types of activities undertaken prevented the development from being well planned or purposeful.

While revision of existing courses proceeded vigorously, very little evidence could be found of specific planning activity, explicit objectives, or basic or "action" research. Only an extremely small number of curriculum changes were ever evaluated after they had been instituted.

The study concluded with specific suggestions for the improvement of programs of curriculum development in large high schools. 306 pages. $3.95. Mic 58-4163

EDUCATION, ADMINISTRATION

INTENTIONS OF VILLAGE AND GOVERNMENT SUBCULTURES IN THE PROMOTION OF RURAL EDUCATION IN INDIA

(Publication No. 25,344)

Merle Aldo Akeson, Ed.D.
Stanford University, 1957

THE PROBLEM It is the purpose of this study to furnish suggestions for the improvement of Indian rural education programs. A study of (1) the Indian national government, (2) vilage subculture, and (3) government and village participation in this rural education program, constitute the bases for the suggestions.

METHOD OF STUDY The government of India has an ambitious and largely successful rural development program for promoting a democratic social revolution. In assessing the reported difficulties and failures of rural programs the cultural factor appears to be crucial due to differences between the government culture directing and

the village culture receiving the program. The bases and results of these cultural differences were analyzed by examining the social structure, stereotypes, and values of: (1) the government as an agent of change, (2) the relevant characteristics of the village, and (3) the consequences of the interaction of these cultural differences in government-village contact situations.

This general analysis was amplified by narrowing the focus of the study to a more restricted problematic setting: government and village behavior in the operation of the rural education program. Points noted were:

1. the statistical and structural background of Indian rural education;
2. government and teacher-agent participation in rural education; and
3. village and student participation in the rural education program and motives for their support.

RESULTS OF THE STUDY The bureaucratic, hierarchal structure of the government with its urbanized cadre, impedes efforts to initiate and direct rural programs. The rigid hierarchy of village social organization formalizes the villager's social and economic relationships and at the same time restricts his opportunities for behavioral change. The variety of negative stereotyped attitudes held by each group concerning the other's beliefs and behavior hinders understanding and joint action. Value conflict exists within the government as well as in its dealings with the villager.

It is to be concluded that for any government rural development program in India, the cultural background of the village agent, the administrative flexibility permitted in the program, and the compatibility of government and village goals, are focal questions to be considered.

Statistically, Indian rural education revealed significant educational progress with persistent problems remaining for some village groups. Two government bureaucracies are working in rural education: the established schools and the Community Development projects.

The government participates in rural education by engaging in numerous planning activities, the chief reform being Gandhi's ruralized Basic Education plan. The government's local education agent - the village teacher - is unique among the officialdom in terms of his village residence, cultural background, and potential for interpreting urban ideas to the villager. The central government has circumvented this local school by selecting the recently established Community Development program as the vehicle to initiate rural development.

On the village level, significant educational contributions are made by different village groups. Student participation is influenced by factors of work, climate, and socio-economic position. Village educational objectives do not match the government's Basic Education plan, nor has the government been able to curb the villager's increasing urban orientation.

PROGRAM SUGGESTIONS The more pertinent suggestions derived from this cultural study relate to:

1. The educational Hierachies: Administrative flexibility and feedback should be accorded the local government agent and villagers' educational objectives.
2. The Village Teacher: Pedagogically and sociologi cally, his professional competance must be improved, his administrative status raised, and his membership in other rural development programs encouraged.
3. The Student and Education: The school program must be more adaptable and less costly in order to promote rural mass education.
4. The Curriculum: The village school should provide academic and social skills that will have utility for urban migration and employment as well as for continued village residence.
5. The School and Rural Development: The village school must be brought into a more active role in the government's rural development plans.

228 pages. $2.95. Mic 58-4164

A STUDY OF THE INTERMEDIATE UNIT OF SCHOOL ADMINISTRATION IN MICHIGAN

(Publication No. 25,192)

Harlan Dennett Beem, Ed.D.
University of Illinois, 1957

Unstructured interviews and brief questionnaires were used to obtain perceptions of county and district superintendents as to the functioning of the intermediate school office in the State of Michigan and attitudes toward its potential development.

The majority of persons interviewed believe that the intermediate unit should persist after schools are reorganized. Less agreement is evinced about the function which the intermediate office should perform after school districts are reorganized. District superintendents tend to assign a large role to the intermediate office closely paralleling the role assigned to the local district.

Conceptions of educational and lay leaders questioned concerning the functioning of the intermediate unit vary greatly.

Among interviewees, there is a tendency to think of the intermediate unit in terms of the job of the superintendent or its chief officer rather than in terms of a unit consisting of a staff of persons. Most of the information elicited from interviewees is descriptive of the job of the chief officer of the intermediate unit rather than of the purposes of the intermediate structure itself.

County superintendents themselves vary in their conceptions of their own jobs. Some look upon their positions as primarily clerical and communicative; some are chiefly concerned with furnishing leadership to small, rural schools; some look at themselves as the educational leaders of the county; and some consider themselves as pioneers in promoting a new concept of the intermediate school unit, that of recognition of the county school board as the primary agent for leadership in caring for the unmet needs of the children of local districts.

Notions of the function of the county school board vary from the idea that its one important task is to select a county superintendent, to the idea that it is the major policy-forming organization for a growing intermediate agency destined to expand the efficiency of local districts.

There is wide variation among the district superintendents as to the appropriate role for the intermediate school unit in general and the existing county superintendency in particular. Moreover, district superintendents in general differ from county superintendents in their perceptions of the job to be done in the county superintendency.

A simple rating of effectiveness of county school offices by a jury of educators tends to vary directly with such items as the training of the county superintendent, his salary, his gross budget, floor space available in his office, amount of time devoted to national educational meetings, and other variables, many of them in turn associated with size and wealth of the counties.

New services to completely reorganized districts are to be found in the wealthy, populous counties rather than those long reorganized. Thus despite variations found in perceptions of effectiveness in the intermediate office in Michigan, visits of the writer to various counties failed to yield evidence that present practice yields sufficient criteria in that state for pointing to a future course of development for this unit; nor is there evidence of sufficient thought among educational practitioners interviewed to conceptualize the unit in its reorganized form.

The conclusion is, therefore, that a clarification of the nature and function of an intermediate administrative school unit in Michigan will require the testing of theory which has been developed largely from practice in other states. 221 pages. $2.90. Mic 58-4165

THE DEVELOPMENT OF FINANCIAL SUPPORT FOR PUBLIC SCHOOLS IN NEW JERSEY

(Publication No. 24,184)

Robert D. Bole, Ed.D.
New York University, 1957

Chairman: Dr. Alonzo G. Grace

The purpose of this study is to set forth the development of the financial support for New Jersey public schools from 1871 to 1956. Justification for this study stems from the dearth of documented historical data on New Jersey school finance and the need for such data as the State seeks to solve its pressing school fiscal problems.

Techniques of historical craftsmanship were used in the preparation of the document. Virtually all of the data were primary in nature, carefully evaluated for accuracy and evidence of bias. Hypotheses were set up and verified, basic generalizations established, historical analogies drawn, causes determined, influences detected, and long-time trends established by means of fifty-six statistically-treated tables.

School fiscal developments were interpreted against a backdrop of contemporary social, political, and economic phenomena as well as against a background of general public school trends. Moreover, considerable attention was devoted to the growth of the State's tax structure, which development played no small role in moulding school fiscal practices.

Evolving school fiscal practices were synthesized and interpreted in two major time periods, the first from 1871 to 1946 and the second from 1946 to 1956. The former lengthy period was divided into five subintervals to facilitate interpretation of data.

The following conclusions can be drawn from New Jersey's school fiscal development form 1871 to 1946:

School fiscal support was predominantly local, state school aid relatively slight.

Too great a dependence was placed upon the local property tax as a school support measure.

In New Jersey's shift from an agrarian to an industrial economy, local property remained the predominant source of school support.

Mandated school services tended to increase without an enlargement of state aid to support them.

Too great a dependence was placed upon earmarked taxes for school support with unfortunate results.

State school monies were distributed in a manner which ignored the fiscal needs and abilities of school districts.

State school aid was never used in a positive manner to encourage school district consolidation.

For the 1946-1956 period the following conclusions indicate that New Jersey began to adopt generally accepted principles of school finance:

Local property as a tax base has been granted relief through the medium of increased state school aid.

The equalization principle of distributing state school aid has been placed into operation.

The State and local school districts, in partnership fashion, are supporting a defensible foundation program in all school districts.

Local district fair share of the foundation program is being determined in a more equitable manner.

Discretionary methods for allocating state school aid have been abandoned; objective measures are now used.

All school districts--rich and poor alike--receive some measure of state school aid.

Earmarked taxes for school support have been discarded.

Recommendations growing out of this study are as follows:

The basic principles upon which the present state school aid formula is based are soundly conceived, and should be retained.

The present $200 per pupil foundation program should be increased to an amount in keeping with current school district expenditure programs.

The local districts should share the increased cost of the foundation program by an increase in the local fair share in the basic state school aid formula.

State school aid should be used in a positive manner to encourage complete school district consolidation.

Any suggestions for reviving the earmarking of tax monies for school support should be examined critically before adoption.

To meet the need of its schools in an expanding future, the State should give careful consideration to the adoption of a broad-based, high-yielding state tax structure.

482 pages. $6.15. Mic 58-4166

A PROPOSED FOUNDATION PROGRAM FOR DISTRIBUTING STATE SCHOOL FUNDS TO THE LOCAL SCHOOL SYSTEMS IN KENTUCKY

(Publication No. 25,014)

John Henry Boyd, Ed.D.
University of Kentucky, 1952

The Problem

It is the purpose of this study to develop a proposed foundation program for distributing state school funds to the local school systems which will more nearly equalize elementary and secondary educational opportunities in Kentucky and guarantee an adequate program for every child.

Delimitation of The Problem

This study is limited to methods of determining the needs of local districts to finance a proposed foundation program of education and methods of distributing state school funds to secure greater equalization of educational opportunity.

The ability of the local districts to finance the foundation program has been limited to an assumed ability as determined in the Mills study.[1]

Sources of Data

In studying the plan of state support for public education in effect during the period 1937-1951, the school laws of Kentucky as well as reports and original records of the State Department of Education were used. Numerous research studies dealing with methods of determining the educational finance needs and the ability of local school systems to finance education were examined.

Procedure

The plan of state support for public elementary and secondary education in Kentucky during the year 1950-51 was evaluated using the School Finance Goals of the National Education Association Committee on Tax Education and School Finance and the Southern States Work-Conference Criteria. Approximately the same weaknesses were revealed by both evaluations. These weaknesses were taken into consideration in planning the Proposed Foundation Program.

Proposed Financial Equalization Program for Education in Kentucky

The needs of local school systems are defined in terms of salaries and expenses of professional personnel, transportation, capital outlay, and other current expenses.

An educational program was first developed calling for a teacher for each thirty pupils, an adequate classroom, and sufficient funds to furnish all the necessary other current expense items. Then the cost was attached to the minimum educational services.

The total cost of the Foundation Program is as follows:

Salaries	$64,311,400.00
Transportation	4,248,606.00
Capital Outlay at $400.00 per classroom unit	7,473,400.00
Other Current Expenses at $1200.00 per classroom unit	22,420,200.00
	$98,453,606.00

State Funds Needed to Supplement Local Revenue

It is proposed that the amount of state aid needed by a local district to finance the foundation program of education be determined by subtracting the ability from the financial needs.

The total cost of the program ($98,453,606) must be shared by the state and the local districts. The major portion of this cost must be borne by the state if there is to be equalization, an opportunity for local enrichment, and assurance that no district will be obliged to curtail any of its program.

The recommended defensible foundation program shown in Plan III provides for the state to distribute to the local districts a per capita fund equivalent to that of 1951-52 ($26,212,500) using the average daily attendance as the pupil factor. The local district would be permitted to levy a tax equivalent to a seventy-five cent tax on property equalized at 66 2/3 per cent of full value. This would produce $35,811,685 in local revenue. An equalization fund of $41,469,201 would be necessary to guarantee the foundation program in all districts of Kentucky. This plan utilizes only half of a reasonable local effort of $1.50 tax on property equalized at 66 2/3 per cent of sale value. The other half of the anticipated local tax revenue in each district could be used for local enrichment.

Concluding Statement

A change in Section 186 of the Kentucky Constitution is necessary if educational opportunities are to be equalized and this foundation program put into effect. Without a change in the constitution, the state cost of the foundation program is prohibitive.

The educational level of the foundation program must be determined by the people in the various districts. The main purpose of this study is the development of a technical application of dollars to a reasonable educational program. 215 pages. $2.80. Mic 58-4167

1. Robert L. Mills. A Method of Measuring The Financial Ability of Kentucky School Districts to Support An Educational Program. Bulletin, Bureau of School Service. Vol. XXIV, No. 1. (Lexington: College of Education, University of Kentucky. 1951) 100 pp.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

A BASIC PERSONNEL PROGRAM FOR NON-PROFESSIONAL PUBLIC SCHOOL EMPLOYEES

(Publication No. 24,822)

Mark Hannah Caress, Ed.D.
Indiana University, 1957

Chairman: W. Monfort Barr

The Problem

The purpose of this study was to prepare from related literature and research a basic personnel program for non-professional service employees in the public schools and to compare the existing personnel practices for non-professional employees in selected Indiana school systems with recommended practices.

Procedure

Related literature in personnel administration and research studies in personnel administration in business, industry, civil government, and public school systems were reviewed. From this review a basic personnel program was prepared for non-professional service employees in public school systems.

With this basic program as a guide the personnel practices carried out for employees in physical plant, business and secretarial, and food services were studied by personal visit to 26 public school systems in Indiana which had a pupil enrollment between 2,000 and 6,500 in 1954-1955.

Findings

The comparison of existing personnel practices with the recommended basic personnel program was made only to determine the existence of certain practices rather than the extent or degree of competence with which they were carried out.

A total of 21 per cent of all employees of the school systems studied were working in the service areas of physical plant, business and secretarial, and food services. Less than one half of the 26 systems were generally providing satisfactory personnel practices for the three service area employee groups.

In each system the superintendent of schools or an official directly responsible to him was the administrator of the personnel program, with four fifths using written policy to provide for personnel practices.

Some findings in relation to specific practices were:

1. All of the systems accepted applications at any time, but only about one fourth made an effort to publicize job vacancies.
2. Only one system of the 26 studied provided any kind of testing program for determining skills and aptitudes of prospective employees.
3. Although all but two of the 26 systems assigned the responsibility for recommending an employee's retention or release after probation to the immediate supervisor, only one system provided any kind of written rating instrument for appraising job performance.
4. The use of written promotion policies was practically non-existant.
5. Slightly more than one half of the systems maintained comprehensive non-professional personnel records in a central location.
6. Written board of education policies provided for in-service training opportunities in only 15 per cent of the systems.
7. Nearly three fourths of the systems had developed wage schedules for each level and type of position.
8. Every system studied provided vacation with pay and sick leave with pay for physical plant and for business and secretarial employees.
9. Each system provided Social Security benefits, and approximately two thirds provided the benefits of the Indiana Public Employees Retirement Act.
10. Group insurance plans were provided by written policy in slightly more than half of the systems.
11. Approximately four fifths required pre-employment physical examinations of non-professional employees.
12. Only 12 per cent of the systems had written policies providing for employee-participant advisory committees in policy formulation.

Conclusions

The following conclusions were drawn:

1. Improvement is needed primarily in the instruction of school administrators to provide adequate training for formulating and carrying out sound personnel programs for non-professional employees.
2. In training, where public schools should logically be looked toward as leaders, the provision of training opportunities and activities for non-professional employees was infrequently found.
3. The conclusion drawn from discussions with employing officials is that many systems were providing employee benefits and services for non-professional workers only when demanded by competition rather than taking leadership in a forward-looking attitude toward assisting employees.
4. Too many school administrators rely on their personal rapport with employees to retain strong employee relations.

163 pages. $2.15. Mic 58-4168

SCHOOL DISTRICT REORGANIZATION IN GREENVILLE COUNTY, SOUTH CAROLINA, 1951-1954

(Publication No. 24,464)

Leslie Emerson Crowley, Ed.D.
George Peabody College for Teachers, 1957

Major Professor: Erick L. Lindman

The purpose of this study was to ascertain and describe changes in public education in Greenville County, South Carolina, 1951-1954, which resulted from enactments (Articles II through VI, Act No. R-256, H-1150, as amended by Act No. R-353, H-1463) by the South Carolina General Assembly in 1951 in the following areas: organization, finance, curriculum, special services, supervision, school plants and community relations; and to place the whole in a national context by reviewing pertinent literature

concerning school district reorganization elsewhere in the United States. The changes in organization and financing of public education in South Carolina have been briefly described to form the state policy background for the study in Greenville County.

Findings of the Study

Educators, in the professional literature, have with one voice asked that school districts be larger in order that each will contain a student population and possess the financial ability to provide the educational opportunities needed by youth.

Almost revolutionary changes have been effected in South Carolina with the reduction in school districts from 1220 to 102; in Greenville County from eighty-two to one. The mean number of pupils per school and the average daily attendance have increased throughout the state. The state has been able to finance a school building program, assume the responsibility and cost of school transportation, provide expenditures for supervision and overhead, and contribute toward increased salaries for teachers.

In Greenville County the office of county superintendent of schools was created and an efficient administrative, supervisory, and special services division was formed. The county was divided into fifteen attendance areas, and planning committees were organized to provide coordination between the central office and the individual schools.

Both the assessed valuation and the tax burden in Greenville County were equalized. Expenditures increased in three areas: instruction, operation of school plants, and fixed charges; but in three areas there were decreases: general control, maintenance, and auxiliary services. Education in the larger unit was more costly, but there were greater returns per dollar than in the smaller units.

Prior to reorganization only two school districts in Greenville County provided any appreciable supervision of instruction. As a result of consolidation an efficient supervisory staff was provided for the Greenville County schools. Conferences were held for supervising principals and central staff members. Increased emphasis was placed on reading comprehension. In arithmetic, emphasis was placed on practical everyday problems. Art became an important part of the school day life of every child. The health and physical education program was developed to include class instruction, intramural activities, and interscholastic athletics.

In Greenville County larger and more efficient school sites were purchased. Many improvements in school facilities were made through additions and renovations.

In an effort to foster the community relations program in Greenville County, weekly staff meetings were held which include administrators, supervisors, and members of the special services division. School officials realized that a potential obstacle to good community relations existed in the fears and objections of the teachers themselves. In selecting supervisors, therefore, careful consideration was given to their knowledge of human relations and county problems and conditions. Many new parent teacher associations were organized to sponsor cooperative projects and to increase mutual understanding between parents and teachers.

The consolidation of schools in Greenville County resulted in changes in almost every aspect of the public school program. 297 pages. $3.85. Mic 58-4169

THE PARENT-TEACHER ASSOCIATION IN SELECTED SCHOOL DISTRICTS IN KENTUCKY

(Publication No. 24,467)

Gene Clark Farley, Ed.D.
George Peabody College for Teachers, 1957

Major Professor: Arville Wheeler

The purpose of this study was to make an analysis of the functions and purposes of the P.T.A. in selected school districts in Kentucky as conceived by members of the P.T.A. and to analyze the data in terms of principles established by writers in the field of parent-teacher relations and to make recommendations for the improvement of same. Analyses were made of one hundred public school P.T.A.'s in the seven geographical regions of Kentucky.

Findings of the Study

1. Ninety-eight per cent of the superintendents and principals interviewed stated that the P.T.A. was one of the best instruments for securing parent and school cooperation. Only 2 per cent of them considered the P.T.A. of no real value.
2. The P.T.A.'s studied met nine times per year in one- to two-hour sessions. Ninety-two per cent of the meetings were held at 7:30 or 8:00 P.M.
3. The membership was found to have a median age of 40.7 years.
4. Parents of younger children participated more actively in P.T.A. work than did parents of older children.
5. The younger teachers showed more interest in P.T.A. work than did the older teachers.
6. Married people with children in school composed 62 per cent of the membership of the P.T.A.
7. Eighty-seven per cent of the school personnel and 27 per cent of the non-school members of the P.T.A. were college graduates.
8. Only 7 per cent of the P.T.A.'s had men for presidents.
9. The proportion of membership to attendance was about 3 to 1.
10. All teachers indicated they were expected by the administration to attend the P.T.A.
11. Income of P.T.A. members was found to have a direct relation to P.T.A. interest.
12. Most P.T.A. meetings were found to be too formal.
13. Most communities were found to favor the P.T.A. as an association.
14. More parents stated that they became acquainted with their children's teachers at places other than P.T.A. meetings.
15. The P.T.A. dues were such as not to prohibit membership to persons of lowest income.

Conclusions

Most of the P.T.A.'s studied tried to function within the scope of the National and State bylaws as interpreted by writers in the field of parent-teacher relations. Most misunderstandings seemed to be due to the lack of knowledge of the bylaws rather than to willful disobedience of them. The leadership of the P.T.A. needs to be improved through workshops and college courses.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The time, place, programs, and atmosphere of the P.T.A. meetings should be arranged so as to attract more men and more members from the low and high income brackets.

Recommendations

1. All administrators should (1) serve as constructive leaders in P.T.A. work, (2) assist the members of the P.T.A. in their activities in order that all stated objectives may be realized, and (3) draw into the P.T.A. all teachers and all parents who feel a sense of responsibility to the school and youth.
2. Knowledge of the State and National bylaws should be made available to all P.T.A. members.
3. The time, place, and variety of programs of the P.T.A. should be improved so as to secure and hold in attendance more men and persons of all economic and social levels.
4. School administrators should not be elected to office in the P.T.A.
5. The P.T.A. should not be the place to settle controversies or private quarrels.
6. The P.T.A. should be the school's best publicity agent.

208 pages. $2.70. Mic 58-4170

THE ADMINISTRATIVE AND EXECUTIVE FUNCTIONS IN SMALL SCHOOL DISTRICTS

(Publication No. 25,351)

William Albert Gustafson, Ed.D.
Stanford University, 1957

This study endeavors to close partially the gap between studies of one-teacher school districts and of large districts employing several administrators.

The problem delineated for this study was: (1) to determine what functions of small school district administration are transferred by trustees to the administrators, (2) to identify the criteria used by trustees in transferring functions to the administrator and the pattern in which the transfer of functions occurs, and (3) to identify and analyze the problems commonly occurring in the process.

Eight California elementary school districts were chosen for this study because they employed their first full-time administrators within the past six years and were within reasonable distance for personal interviews.

The methods employed in the study included structured interviews and the inspection of records of the districts and counties. A tentative information guide was prepared to control the collection of information after reviewing the literature and the laws of California regarding school district administrative functions. After a pilot study, the information guide was revised and interviews were conducted with thirty trustees, eight district administrators, and two county superintendents of schools.

The data so gathered were analyzed, and the results were synthesized to present findings, problems, conclusions, and recommendations.

Fifteen functions were found to be released totally or in part to the district administrators, according to various combinations of the following factors: (1) time consumption and routine nature, (2) special training and competence of the administrator, (3) confidence of trustees in the philosophy of the administrator, and (4) expression of the authority of the district. The reasons which delayed transfer of functions were local political considerations and major expenditures of district funds.

The functions were released to the administrator in approximately the sequence listed below:

Routine clerical functions
Work scheduling
Staff organization
Planning of instruction
Plant operation
Teacher control
Detailed budget planning
Supervision of instruction
Contacts with county superintendents
Public relations
Personnel selection
Salary recommendation
Policy initiation
Selection of items for purchase
Details of school building planning

The first six functions listed were transferred by all eight districts to the administrator by the end of the first year of full-time administration. Those lower on the list were retained in part by some governing boards for a longer time.

Reasons given by trustees for employing a full-time administrator were: (1) realization of district growth and quantity of work performed by the administrator, (2) financial ability of the district, and (3) deleterious effects on the teaching administrator's students.

All districts increased teacher loads to finance administrative costs.

All districts offered their teaching administrators the full time positions.

Problems mentioned as occurring in the establishment of full-time administration stemmed from a lack of clear definition of policies and administrator's responsibilities. Additional problems were noted in the lack of time and attention given to appraisal of the educational program and supervision of instruction, and in efforts to limit expenditures rather than determine the desirable and necessary program.

Additional research is recommended on: (1) unsuccessful administrators in districts of similar size, (2) the process of employing the first certificated teaching administrator, and (3) the values of subordinate administrative experience before employment as chief administrator of a school district.

Recommendations are given for improvement of practices at state, county, and local levels in order to alleviate the disadvantages to students in these and similar small districts. The recommendations are concerned mainly with formation of adequate school districts, the initial and ongoing orientation of trustees, and the encouragement of administrators to use critical appraisal technics and increase effectiveness of instructional supervision.

154 pages. $2.05. Mic 58-4171

A CRITICAL APPRAISAL OF THE OHIO COUNTY HIGH SCHOOL

(Publication No. 23,705)

Granville Sharp Hammond, Ph.D.
The Ohio State University, 1952

The citizens of Ohio expect a great deal from their schools. Certainly an educational program to develop insight, cultural understanding, and breadth of vision for the solving of problems of general interest is commonly desired. It is, therefore, understandable that attention is increasingly being directed toward the establishment of high schools that can provide a fully integrated school program.

In order to consider intelligently changes in the organization of high schools and school districts, effort must be made to determine the existing conditions. When such conditions are ascertained, then tentative steps may be formulated for improvement.

It is the purpose of the dissertation to study the large and small county high schools in Ohio to determine (1) the professional preparation, salaries, experience, social background, and responsibilities of the supervising principal of these schools, (2) the educational background, marital status, experience, salaries, teaching load, certification, and size of the teaching staff of these schools; (3) the number, types, differences, and per pupil costs of the many subjects in the curricular program of these schools; (4) the needs of the high school seniors of 1950 for formal education beyond the twelfth grade and the need for an extension of the existing curricular program as expressed by the seniors of the class of 1950 in these schools; and (5) the need for an improved organization of the Ohio county high schools so that they may serve more adequately the youth of secondary school age.

The type of school district which maintains the Ohio county high school is defined in section 4830-4 of the Ohio General Code. It states "that territory of a county, exclusive of the territory embraced in any city or exempted village school districts, and excluding the territory detached therefrom for school purposes, shall constitute a county school district." These school districts supported 841 county high schools in Ohio in 1949 and served most of the rural population of Ohio. The county high schools employed 39.4 per cent of the teachers and enrolled 34.2 per cent of the students found in the high schools of Ohio.

The data for this study were obtained from three sources. The first source was an annual report which the supervising principal of each county district must submit to the Department of Education of Ohio. The report contains information relative to the curriculum, the teaching staff, the student enrollment, the library, the teaching load, and items of a similar character. The second source data was the Ohio County Schools Inquiry. This inquiry was developed to collect data considered as a supplement to the annual report. It was sent to the supervising principals to secure information regarding membership in professional organizations, practices used in in-service teacher education, changes in the curriculum, and additional items deemed necessary for a more complete understanding of the county high school in Ohio. The third source of data was the Educational Needs Inquiry which was sent to the high school seniors attending the selected Ohio county high schools. This inquiry sought to obtain the vocational plans of the seniors with greater emphasis given to those students who were (1) uncertain concerning future education, and (2) planning to enter an occupation that requires training beyond high school but does not require a four-year college or university course. The three enumerated sources and a study of appropriate professional literature comprise the sources of data used in this study.

All data in this study were organized according to five school groups which were based upon the enrollment of students reported in grades nine through twelve. Group I was composed of high schools with less than 51 students; Group II was composed of high schools with 51 to 100 students inclusive; Group III was composed of high schools with 101 to 150 students inclusive; Group IV was composed of high schools with 151 to 250 students inclusive; and Group V was composed of high schools with over 250 students. The high schools classified according to the five groups were selected from files located in the Department of Education of Ohio. Within each county file, the high schools were organized in alphabetical order according to the official name of the high school. Every tenth school was selected until ten per cent of the total number of schools in each group was listed. This procedure resulted in the selection of 12 high schools from 12 different counties to represent 120 high schools in Group I, 37 high schools from 34 different counties to represent 367 high schools in Group II, 18 high schools from 18 different counties to represent 178 high schools in Group III, 13 high schools from 13 different counties to represent 127 high schools in Group IV, and 5 high schools from 5 different counties to represent 45 schools in Group V.

An examination of studies which involved questionnaires sent to Ohio county high schools revealed that returns are usually less than fifty per cent of the sample group. In order that this study might utilize the specified ten per cent, an additional ten per cent were selected according to the five groups established. Consequently, twenty per cent of the supervising principals received the Ohio County Schools Inquiry which was used as a supplement to the annual report filed with the Department of Education of Ohio. From this lengthened list, 63.5 per cent returned the inquiry, insuring returns from more than ten per cent of the county high schools. The seniors attending the schools used in this study responded to the Educational Needs Inquiry.

The dissertation presents the findings in nine chapters. Chapter I is an introduction to the study which relates the methods of the study and the sources of data. Chapter II deals with the professional preparation, renumeration, and responsibilities of the local school administrator. Chapter III treats the general background of the teaching staff, including such items as professional preparation, salaries, tenure, teaching load, certification, professional memberships, and professional improvement. Chapter IV develops four general curricular theories as a background for the subject matter curriculum, which is examined in detail. Class size, per capita costs, and curricular changes are also considered. Chapter V examines such topics as the functions of the library, number of books and periodicals, financial expenditures, and qualifications of librarians. Chapter VI treats the extracurricular activities, the homeroom period, and the organization of guidance activities as they function in the Ohio county high school. Chapter VII develops the needs of high school

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seniors of 1950 for formal education beyond the twelfth grade and their expressed need for the extension of the existing curricular program. Chapter VIII summarizes the most pointed findings, which indicate the need for district reorganization, and develops suggestions for permissive legislation to reorganize existing districts. Chapter IX reviews some of the highlights of the study which tend to show the superiority of the larger high school; an interim program to improve the small high school is proposed; and the need for the upward extension of the high school to include the thirteenth and fourteenth years as a means of meeting the needs of the youth attending the Ohio county high schools is presented.

Conclusions and Recommendations

The conclusions of this study indicate that the large county high school is superior to the small county high school. The supervising principal in the large high school has (1) more training, (2) longer tenure, (3) higher salary, (4) larger blocks of time for supervision, and (5) more adequate clerical assistance. The average teacher in the large high school has (1) fewer preparations, (2) fewer classes, (3) more free periods, (4) a high salary, (5) longer tenure, and (6) more professional training. The curriculum in the larger high school has (1) a greater variety of subjects, (2) adequate class enrollments, (3) a lower per capita cost, and (4) a greater variety of extra-curricular activities.

A program for improving the Ohio county high school involves (1) the reorganization of school districts as a means of achieving larger high schools and (2) the upward extension of the county high school to include the thirteenth and fourteenth years. Recommendations to implement these two proposals include (1) the creation of county committees to study redistricting of schools, (2) provisions for leadership and consultant services by the State Department of Education, (3) state financial assistance for buildings in newly created but sparsely populated districts, (4) amendment of section 4831-3 of the Ohio General Code to permit filing of petitions for redistricting each year prior to the first day of February rather than on even numbered years, (5) provision for legislation granting county boards of education the authority to employ consultant services to develop plans of reorganization, and (6) provision for legislation to permit public boards of education to establish and maintain community colleges. 351 pages. $4.50. Mic 58-4172

Abstract published by special arrangement with The Ohio State University.

INDUCTION PROGRAMS FOR ELEMENTARY SCHOOL TEACHERS IN TENNESSEE

(Publication No. 24,474)

W. Richard Hargrove, Ed.D.
George Peabody College for Teachers, 1957

Major Professor: Harold D. Drummond

The purposes of this study were to: (1) ascertain the administrative procedures and induction services employed in induction programs for elementary school teachers of selected school systems in Tennessee; (2) appraise the induction programs of these selected systems; and (3) formulate suggestions for induction programs for new elementary school teachers in Tennessee school systems. The induction programs of the selected systems were analyzed with regard to certain administrative procedures and induction services. These aspects of the induction programs were appraised in the light of related literature, judgments of a panel of educational authorities, and opinions of new teachers. Suggestions were offered relative to induction programs for all Tennessee school systems. These suggestions were based upon the data from sources employed for the appraisal and the experiences reported by representatives of the selected systems.

Findings of the Study

Many induction services for all new teachers were provided in each of the selected systems. Induction programs of selected school systems in Tennessee were characterized by cooperative efforts to help new teachers. Such efforts were generally accompanied by continuous and interested leadership. The induction services were rated by new teachers as being clearly helpful to their induction. New teachers indicated that these services were provided, in a majarity of instances, at the appropriate time.

Insufficient knowledge relative to the needs of new teachers accounted for several weaknesses discovered among the induction programs. Incomplete knowledge of such needs appears to have resulted in the formulation of too few purposes and inappropriate purposes to be served by induction activities.

Other deficiencies were found among the induction programs. There was little relationship between the purposes and services of induction programs. Adequate budgetary support for induction programs was lacking in the selected systems. School leaders acknowledged that few efforts were made to secure additional budgetary sup port for the induction program. Evaluation procedures directed too little attention to needs of new teachers still to be met through the induction program.

Suggestions offered as a part of this study were predicated upon the conviction that induction programs are needed in Tennessee school systems where there are new elementary school teachers. More school personnel need to understand the contribution to induction which can be made by improved recruitment and selection of new teachers. An induction committee or group should plan, coordinate, and organize various aspects of the induction program. School leaders and boards of education need to give more attention to the budgetary requirements of an effective induction program. Purposes of induction programs should be planned on the basis of the well-defined needs discovered among new teachers. Services should then be devised or chosen to satisfy these purposes. Evaluative procedures should be employed to determine the efficacy of these services in meeting purposes. Community involvement in appropriate activities relative to the induction program should be sought by school leaders. It is believed, on the basis of this investigation, that induction procedures are of greatest value when provided in a climate of warm human relationships.

311 pages. $4.00. Mic 58-4173

A STUDY OF EDUCATIONAL NON-CREDIT FIELD SERVICE PROGRAMS OFFERED TO PUBLIC SCHOOLS BY COLLEGES AND STATE DEPARTMENTS OF EDUCATION

(Publication No. 24,828)

Donald Berry Hunter, Ed.D.
Indiana University, 1957

Chairman: August W. Eberle

Problem

The purpose of this study was to determine the status of non-credit educational field service programs in state supported member institutions of the American Association of Colleges for Teacher Education and state departments of education and to determine practices and opinions concerning the development, improvement, and administration of field service programs.

Procedure

A search of the literature was made to determine what field services were being offered and the principles of administering field service programs. A questionnaire was then sent to the presidents or deans of the state supported member institution of the AACTE and to the chief state school officers. Of the 283 questionnaires which were mailed out 89 per cent were returned. The results of these forms were then analyzed in the light of recommended principles, practices, and proposed hypotheses.

Findings and Conclusions

(1) All colleges, universities and state departments of education studies offered some field services and there is wide agreement among college administrators and chief state school officers concerning the fact that there is a need for these services. (2) The offering of all field services studied, except locating teacher personnel for the local schools, is a dual responsibility of the state department of education and the teacher education institutions. (3) There is a definite need for coordination of field service efforts among teacher education institutions and state departments of education. (4) The lack of need for field services is not generally a cause for the failure of colleges, universities, and state departments to provide specific services. (5) Most colleges and universities do not have within their institutions a written statement of objectives for their field service programs. There is, however, a trend for colleges to develop such a statement. (6) Within most institutions studied there are faculty members with regularly released time for participating in field service activities, and this time was considered of comparable importance to resident instruction in the work load of faculty members. (7) The means used by teacher education institutions or state departments of education for letting the public schools know of the field services which they have available for them do not reach all or most of the public schools. (8) Colleges and universities typically make one official other than the president or dean responsible for the direction and administration of field services.

Recommendations

The following recommendations are made in the light of the findings of this study. (1) There should be created within each state a committee which represents the institutions offering field services, the state department of education, and the public schools, which would coordinate field service activities within that state. This coordination would tend to provide better field service coverage of the state; tend to eliminate wasted time, effort, and money; and improve the quality of field services offered. (2) Each teacher education institution which offers more than three field services should have one person or office other than the dean or president, which is responsible for the administration and coordination of field service activities. (3) Each college, university, and state department of education which performs educational field services should make a concentrated effort to determine the educational value of each service performed and let every public school within the state know of the services which are available to them.

172 pages. $2.25. Mic 58-4174

AN APPRAISAL OF THE PERFORMANCE OF STATED FUNCTIONS BY PUBLIC JUNIOR COLLEGES IN MISSISSIPPI

(Publication No. 24,829)

Murray Wilson Kenna, Ed.D.
Indiana University, 1957

Chairman: August W. Eberle

The purpose of the study was to determine the extent to which Mississippi public junior colleges were fulfilling the purposes for which they were established.

The history and operation of each of Mississippi's public junior colleges were studied in an effort to answer the following questions:

1. What were the purposes envisioned by the Mississippi State Legislature in establishing a state system of junior colleges?
2. What are the purposes toward which the junior college administrators and officials consider themselves to be working?
3. To what extent are the purposes envisioned by the legislature and the explicitly stated purposes of the junior colleges being fulfilled?

The following steps were followed in attacking the problem in the study:

1. The related research was reviewed.
2. The history of the Mississippi public junior college system was traced.
3. The laws of the State of Mississippi relating to junior colleges were studied and the purposes which the legislators envisioned for these institutions were determined.
4. The current catalogues of all public junior colleges in Mississippi were studied to determine what purposes the junior college officials considered vital to their institutions.
5. Explicit purposes, both legislative and institutional, of the junior colleges were tabulated.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

6. Evaluation criteria were constructed to measure actual performance of each stated purpose.

7. Evaluation criteria were validated by submission to a jury of experts.

8. Evaluative criteria were applied to each public junior college in Mississippi through visits to its campus and conference with its administration.

On the basis of the data gathered during the study, the following conclusions were drawn:

1. The public junior colleges of Mississippi were providing two years of accredited college work toward a degree, with the exception of certain highly specialized professional degree programs.

2. A general education program was being provided for students in the senior college preparatory programs in Mississippi public junior colleges.

3. General education programs were not being provided for students in the vocational-technical divisions of the junior colleges.

4. Adequate information and curricular advice was available to junior college students preparing to transfer to degree programs in senior colleges.

5. The educational needs of the adults in the several junior college districts in Mississippi had not been identified and were not being met.

6. Little was being done by the junior colleges specifically to help improve living standards in their communities.

7. No citizenship training programs were being provided. Such training in citizenship as was provided was a secondary result of regular college classes.

8. Mississippi public junior colleges were providing two years of accredited college work at substantially lower cost both to the taxpayer and to the student.

9. The influence of the home was being prolonged in the junior colleges because of the large number of commuting students and the close proximity of the homes of most boarding students.

10. Vocational needs had not been ascertained in any of the junior college districts by any organized method of study.

11. Such vocational programs as were in operation in Mississippi public junior colleges had been developed haphazardly, without real attention to the needs of the community or the student.

12. Occupational information and guidance were provided by all of the junior colleges, with the exception that no facilities were available for testing vocational aptitudes at any of the institutions studied.

13. The assistance given to veterans consisted primarily of advice and assistance in obtaining educational benefits under the various laws pertaining to ex-service men.

14. Personal guidance services were not being provided by most of the junior colleges.

15. Educational guidance in the colleges studied consisted primarily of planning programs for transfer to senior colleges.

16. Little attempt was being made to develop aesthetic appreciation among vocational students, and very little effort was being made in this direction among regular academic students.

17. Adequate spiritual advice and guidance were available in Mississippi public junior colleges.

136 pages. $2.00. Mic 58-4175

AN ANALYSIS OF THE RELATIONSHIP BETWEEN SELECTED FACTORS AND PERSISTENCE OF PUPILS IN SCHOOL

(Publication No. 25,243)

Addison Hugh Livingston, Ed.D.
University of Illinois, 1957

The last half century has seen the goal of a secondary education for all American youths become rather widely accepted by our society. That substantial progress toward the achievement of this goal has been made during the period is evidenced by the fact that the high schools of the nation are graduating a greater proportion of youths than has ever been the case.

A great deal of research has been carried on in the years since the end of World War II for the purpose of identifying the characteristics of, and the problems faced by, the sizeable proportion of American youths who withdraw from school prior to graduation from grade twelve. Certain limitations and omissions prevent the fullest utilization of the results of this research in the development of programs designed to retain the dropout in school.

This study was designed to achieve three major purposes: To review the literature on dropouts for the purpose of developing a list of characteristics thought to be typical of the potential early school leaver; on the basis of data concerning the list of characteristics thus identified, to compare graduates and dropouts who entered the schools of a particular community in the first grade; and to examine seemingly reasonable combinations of these individual factors for the purpose of securing an improved basis for predicting proneness to early school leaving and more accurate knowledge concerning the pupil who withdraws from school.

The relationship between the criterion and each of the twenty-four individual characteristics selected for use in this study was examined by use of the Phi coefficient of correlation. The five percent level of confidence was chosen as that level which was sufficiently rigorous and yet reasonable in facilitating further exploration and research.

The pupils who entered the public schools of Reedville, Illinois in 1944-45 and either graduated or voluntarily withdrew prior to graduation comprised the sample used in this study. A total of 193 graduates and 116 dropouts were included.

Eighteen of the twenty-four individual characteristics or indices were found to be significantly related to the criterion of graduation or non-graduation from grade twelve. The notable exceptions in the results of this study as compared to the findings in previous studies included the fact that the occupation of the principal wage earner of the pupil's family, the sex and race of pupil, the age at school entrance, and the stability of the pupil's home failed to exhibit a significant relationship with graduation or non-graduation from grade twelve.

The analysis of the seemingly reasonable combinations of the individual factors which had proven to be significantly related to the criterion revealed a rather high multiple correlation coefficient when four variables were included in the composite. No combination of any two indices resulted in a multiple correlation coefficient which was appreciably higher than that secured through the use

of the most highly related elementary school index. The combination of four variables yielded a multiple correlation coefficient of .70 indicating that this combination accounted for approximately one-half of the variance between the graduates and dropouts in this study. The addition of a fifth and sixth variable resulted in an actual reduction in the size of the relationship observed.

The results of this study indicate that a fundamental reconsideration of this problem is needed. Rather significant aspects of the problem are apparently being overlooked at the present time. It appears that the balance of forces playing on the pupil contributes to the formation of an attitude toward education which may be instrumental in determining the persistence of the pupil in school. Subsequent research should probably attempt to assess the importance of this attitudinal dimension in relation to the dropout problem. 115 pages. $2.00. Mic 58-4176

FACTORS THAT DETER COLLEGE ATTENDANCE: A COMPARATIVE STUDY OF SELECTED 1955 INDIANA HIGH SCHOOL GRADUATES

(Publication No. 24,835)

Nicholas Thomas Mannos, Ed.D.
Indiana University, 1957

Chairman: August W. Eberle

The Problem: The purpose of this investigation was to determine, by means of the interview technique, the reasons that deter talented youth from attending college. The basic premise which this study pursued was directed toward an analysis of the factors of deterrence and their interrelationships in regard to college attendance for the youth involved.

Procedure: Specifically, the problem of this investigation was to attempt to discover reasons for the failure of members of the upper 10 per cent of selected 1955 Indiana high school graduates to attend college. Members of this group who did not go on to college, their high school principals, and their parents were interviewed, and their responses to questions in a directed interview were compared to the responses made by members of the same group who were attending Indiana University in 1956-1957. The persons whose responses were compared were matched according to sex, age, approximate rank in class, and school attended. A total of 240 interviews were conducted throughout 29 Indiana counties wherein 51 high schools were represented. Eighty Indiana University students, who could be matched with the non-attending graduates according to the previously cited criteria, were interviewed at the Bloomington campus or at the Medical Center, Indianapolis, Indiana. The interview questions probed the areas of deterrence, such as parental attitudes, finances, peer influences, student motivation, etc., and also tested the consistency of data among the four interview schedules.

Conclusions: In accordance with the findings of this study, the following conclusions were drawn relevant to the factors that deter or encourage talented youth toward a college education:

1. Factors of deterrence are highly interrelated and are a result of family and community backgrounds, coupled with the personal desire and values that youth places upon higher education.

2. The most significant factors that deterred college attendance were lack of interest and marriage. Finances were revealed as third in rank of the factors studied. These stated factors were consistent among the three interviews. Of the attending graduates, personal interest was revealed as the primary factor that was responsible for college attendance. Positive parental attitudes and high school motivation were also stated as primary factors that encouraged college attendance.

3. Secondary factors that contributed to college deterrence were stated in order of rank as (1) negative parental attitudes, (2) finances, (3) distance from school, (4) marriage, (5) lack of interest, (6) personal illness, and (7) peer influences. Secondary factors of encouragement toward college attendance are positive parental attitudes and adequate finances.

4. A significant number of communities reveal negative attitudes toward higher education.

5. Parents of attending students are more likely to belong to community service organizationa than the parents of the non-attenders.

6. Most high schools have some type of college orientation programs; however, a few indicate no programs relevant to college orientation at all.

7. Positive parental attitudes are a vital influence toward students' attendance at college.

8. The effect of peer influence is insignificant; however, a higher percentage of attenders' close friends do go on to college as compared to the friends of the non-attenders.

9. Attending graduates are significantly more aware of scholarship opportunities than were the non-attenders.

10. Attenders realize the value of higher learning, whereas non-attenders consider work and marriage as most important.

11. More siblings of the attenders than of the non-attenders attend college.

12. Parents who have attended college are more likely to send their children to college.

173 pages. $2.30. Mic 58-4177

DEVELOPMENT OF CRITERIA FOR AN INTERMEDIATE SCHOOL DISTRICT AND THEIR APPLICATION IN ILLINOIS

(Publication No. 24,832)

Norman Eugene McClintock, Ed.D.
Indiana University, 1957

Chairman: W. Monfort Barr, Ed.D.

The purpose of this study was to develop criteria for an intermediate unit from related literature and research;

to develop suitable intermediate units for the State of Illinois on the basis of the criteria; and to suggest organizational and operational procedures that would permit effective utilization of the intermediate units.

Methods, Procedures, and Sources of Data

Literature were review in the field of state school administration as it pertained to the intermediate unit. Criteria for an intermediate unit were developed from the findings of this review.

Data concerning the public elementary and secondary schools of the State of Illinois were collected from official publications of the Illinois State Department of Public Instruction, other state-wide publications, regional, and national publications. These data were analyzed, interpreted, and related to criteria previously established as being necessary for an effective and economical intermediate unit.

Conclusions

The findings of this study indicated that an intermediate unit could operate most effectively and economically as an agency that provides services to the local school district and to the state office of education if the following criteria are met:

1. The functions of an intermediate unit should be clearly defined in the state law in order that the formal relationships of the organization may be established.
2. The organizational structure of the intermediate unit should provide for an elected lay board of education, an intermediate administrator, and an intermediate staff.
3. An intermediate unit should be comprised of two or more local administrative districts that are considered to have insufficient enrollment to provide a comprehensive program of education in an effective and economical manner.
4. Provisions should be made whereby satisfactory local administrative units, those containing a student population of 12,000 or more, may share in the service program of the intermediate unit on a cost basis at the request of the local administrative officials.
5. A minimum of 15,000 students in the elementary and secondary schools is necessary in order that the intermediate unit may complement and supplement the program of education at the local district level at a reasonable per capita cost.
6. A total population of 75,000 is the minimum that should be included in an intermediate unit.
7. A satisfactory intermediate unit should have a minimum of 500 professional employees serving in the local administrative units underlying the intermediate unit.
8. The intermediate area should, in so far as possible, represent an area in which the people have some common interest; the recommended desirable maximum size is 1,000 square miles.
9. Minimum financial support for a satisfactory intermediate unit is that which is needed, complemented by state support, to provide services required by local school districts in order that a comprehensive program of education may be available to every child residing therein.
10. The services of an intermediate unit should complement and supplement the services offered by the local districts comprising the intermediate unit in order that a comprehensive program of education may be provided for all children residing within the area served. These services may generally be classified as administration of attendance, education of the exceptional child, supplementary vocational education, adult education, provision of specialized guidance services, health services, and business management.

It was further concluded that an intermediate system with about one half the number of intermediate districts now existing in the State of Illinois could be developed if the existing intermediate system were reorganized in the light of criteria such as has been developed in this study. If the existing intermediate system were reorganized, approximately one half of the funds now used to operate the intermediate system could be used to supplement and complement the services now provided the local school districts through the intermediate system.

159 pages. $2.10. Mic 58-4178

AN ANALYSIS OF SELECTED CHARACTERISTICS, WITH PARTICULAR REFERENCE TO THE EDUCATIONAL AND VOCATIONAL PLANS, OF INDIANA UNIVERSITY FRESHMEN

(Publication No. 24,833)

Kenneth Edward McDiffett, Ed.D.
Indiana University, 1957

Chairman: H. Robert Kinker

The study constitutes an investigation of the relationship of selected biographical factors to the educational and vocational plans of a group of university freshmen. The study involved an investigation of personal background data and the decisions dealing with the educational and vocational goals of the students.

The introduction contains a discussion of the significance of the problem as it relates to educational and vocational planning on the part of college freshmen and the importance to personnel workers, especially to the student counselor. A review of educational and psychological related literature dealing with various aspects of the problem is also reported.

The subjects used in the investigation consisted of approximately a 30 per cent random sample of the dormitory freshmen who enrolled at Indiana University in September, 1955. There were 466 students, 248 men and 218 women. The main source of data consisted of the responses to a questionnaire which was based on a pilot study.

In the main, the treatment of the data made use of the chi square statistical technique for determining the degree of independence between the biographical variables and the educational and vocational criteria. Statistical significance was calculated at the ten, five, and one per cent levels of confidence.

The major findings and conclusions were:

1. Sex, education of siblings, and education of parents appeared to be highly significant biographical factors affecting the year the students considered going to college.
2. Sex, number and education of siblings, parental occupations, annual parental income, and the size of the home town appeared to be major factors affecting the

decision concerning the year the students decided to attend the university.

3. Number and education of siblings, occupation of mother, education of father, and size of high school were background factors affecting the main reason for enrolling in college.

4. Number and education of siblings and high school size seemed to be significant factors in determining the satisfaction of the original reason for attending college.

5. Sex and yearly parental income were factors which most often affected the choice of academic areas of greatest interest.

6. Sex and education of parents were significantly reflected in the stage of realization of the greatest interests.

7. Sex appeared to influence the degree of relationship of main interest to school studies.

8. Annual parental income seemed to have a bearing on the relationship of main interests to out of school contacts.

9. Number of siblings and occupation of father appeared to affect the type of interest being pursued.

10. Education of siblings seemed to influence the reason certain interests were not being pursued.

11. Sex and education of mother appeared to be significantly related to the occupational choice.

12. Sex, occupation of parents, and high school size were factors influencing the source of the occupational decision.

13. Number of siblings appeared to influence the attitudes toward the utilization of tests and school records and the assistance of university counseling.

14. Size of home town appeared to influence the attitudes toward the availability of university counseling.

The findings and conclusions in this study seem to warrant the following recommendations.

1. It is recommended that studies be initiated on the secondary school level which will involve investigations of areas similar to those included in the present study.

2. It is recommended that increased emphasis be placed on providing pertinent occupational information at the college level, perhaps beginning as part of a freshmen orientation program.

3. It is further recommended that additional research be conducted at the college level involving the investigation of the educational and vocational plans of the freshmen students. 180 pages. $2.35. Mic 58-4179

INEQUALITIES ARISING FROM PRESENT ORGANIZATION OF ST. LOUIS COUNTY SCHOOL DISTRICTS

(Publication No. 25,129)

Edgar Carl Miller, Ph.D.
St. Louis University, 1957

The purpose of this study was to analyze the inequalities among St. Louis County, Missouri, school districts in their ability to support education; to show the relationship of these inequalities to the present school district organization; and to determine whether the solution of the problem of inequality lay in the direction of reorganization.

Procedures included the submission of a questionnaire to the superintendents of the St. Louis County school districts, an analysis of financial and other statistical data available at the office of the County Superintendent of Schools, and a study of the nature of suburbia, especially of St. Louis County, from publications of the St. Louis County Planning Commission and others.

The principal findings of the study included the following:

(1) The tendency for economic equals to live in the same geographic areas and the cluster of industry cause an unequal distribution of taxable wealth throughout suburban areas.

(2) The inequalities in ability to support education among St. Louis County school districts arise from the present organization of twenty-nine independent school districts within an area varying widely in taxable wealth. (The wealthiest school district in St. Louis County had a tax base of $37,521 in assessed valuation per pupil in average daily attendance whereas the poorest had only $2,201.)

(3) Because of the geographic distribution of taxable wealth, the only solution to the problem of inequalities in ability to support education is the reorganization of St. Louis County into one school district.

(4) Organization of St. Louis County into one school district would provide equality of educational opportunity for all County children, would provide sufficient bonding capacity to finance all present building needs, and would be able to provide facilities for vocational training and for the education of the atypical child.

Major recommendations of this study are:

(1) That the St. Louis County School Board submit a one-district plan of reorganization of St. Louis County to the State Board of Education for approval and that such reorganization plan then be submitted to the voters of St. Louis County as provided by law.

(2) That the reorganization law of Missouri be strengthened to require all Missouri county boards of education to submit additional plans of reorganization to the State Board of Education until the State Board declares that the county is adequately organized.

(3) That the reorganization law be further strengthened to impose penalties against school districts which continually vote against reorganization plans which have been approved by the State Board of Education, such penalties to take the form of withholding additional state school money to such districts.

(4) That more study be made nationally on the problem of suburban school districts.

272 pages. $3.50. Mic 58-4180

CONTROL OF PUPIL TRANSPORTATION COSTS IN CALIFORNIA ELEMENTARY SCHOOL DISTRICTS

(Publication No. 25,356)

Harry Arthur Nethery, Ed.D.
Stanford University, 1957

The Problem

During the period from 1919 to 1950, the number of pupils transported daily in the United States has risen

from 350,000 to 6,980,189. Pupil transportation has increased at a faster rate than national enrollment. The two main contributing factors have been reorganization and consolidation of school districts and the use of buses for broadening the curriculum. Available information indicates the growth of pupil transportation in California exceeds national averages. Transportation costs are taking an increasingly larger portion of each dollar spent for education. This dissertation is devoted to establishing methods and providing information by which a school district may effectively administer its student transportation system.

The primary hypothesis of this study was that information obtained from the bus fleets of sixty-one elementary districts would provide the bases for developing management measurement tools. Certain questions needed to be answered. Do certain uncontrollable factors such as terrain, socio economic level, etc., have measurable effects on costs; what are their relative importance; or do controllable factors, i.e. size of supervisory force, methods of repair, etc., have the greatest effect?

Procedure

A case study was made of one district that instituted a definite transportation policy. In this study, a three year cost analysis was made to determine the results of such a policy.

Several cost formulae were developed to measure the over-all effectiveness of districts' transportation systems. Controllable and uncontrollable influences on costs were correlated to these formulae to determine the relative importance of the former. In addition, various analyses were made by classifying information and comparing data by means and medians.

Another method employed was the development of unit cost criteria from eight districts with the best over-all performance formulae indices.

The same eight districts were used to establish the last management measurement criteria. Optimum percentages in the various operating cost classifications were developed as a percentage of total operating expense.

Limitations as to the methods used in developing this information and the use of these measurement devices are set forth in the appropriate sections of the dissertation.

Results

In the area of uncontrollable costs, only the pupil density and the amount of double session had an apparent effect on over-all performance.

In the controllable areas, transportation policy development had a significant effect on costs when analyzed on a year to year basis. The amount of supervision and the methods of repair had their effects on over-all fleet costs.

The application of cost criteria to districts with average or poor performance indices provided definite evidence that generally excessive costs were found in the areas of labor and repairs. Use of optimum percentages by expense classification indicated that, while unit labor and repair costs were lowest in the best districts, the percentage amount spent for these was higher than in the average and inefficient districts.

Conclusions

The management tools developed provide measurement criteria by which administrators may effectively analyze fleet operation and determine those areas in need of improvement. Only by effective management will pupil transportation systems fulfill their part in the total educational program without taking a disproportionate share of the instructional dollar. 159 pages. $2.10. Mic 58-4181

PROBLEMS OF WOMEN TEACHERS IN IRAQ

(Publication No. 25,357)

Hind Tahsin Qadry, Ed.D.
Stanford University, 1957

To provide an objective description of the problems encountered by women teachers in the public primary school system of Iraq as an aid for counseling girls who may be interested in entering the profession is the goal of the study. Group interviews involving a total of 250 teachers at fifty primary girls' schools in Iraq were made using a pretested interview schedule. A purposive stratified quota sample design was used to insure that regional variations of a social and geographical nature would be represented.

Physical and historical characteristics of the country are indicated as having only slight impact on the present school system. Developments since 1930 have encouraged the expansion of the system generally along the lines of the British and continental systems. Women's education was slow in gaining acceptance but is now well received. The training programs for women teachers have undergone frequent changes usually in the direction of higher entrance standards and longer programs.

The group of teachers interviewed is shown to be reasonably representative of the total universe of primary school women teachers if randomness of the sample is assumed for statistical purposes. According to the sample half of the teachers have entered the educational profession since 1948; nearly one-third were originally from the province of Musul; more than 75 percent are Muslims; most come from homes in which their fathers are engaged in trade and commerce or civil service; over one-third are married and of these eighty percent of their husbands are either civil servants, professionals, or are in the military service.

Problems of the teachers which are focused on the institutional system are categorized under attitudes and practices, regulations, facilities, and programs. In reviewing, frequent use of personal quotations is made which places the abstract analytical findings in a situational context. Problems with pupils cover attitudes, classroom behavior, physical conditions, and age-grade problems. Problems whose locus is in the school community are reviewed under attitudes and practices, parent-teacher relations, and socio-economic conditions. The analytical reviews are summarized by indicating the probable consequences of the problems for the newly appointed teacher.

A general evaluation of the career as viewed by those in the profession is presented in an attempt to judge the relative importance of the problems for over-all satisfaction with teaching. It is shown that three-fourths of the parents of women teachers approve of their daughter's job, and husbands are only slightly less satisfied. Fifty-four percent of the communities where the schools are

located fully approve of women teachers. As for the teachers themselves seventy-one percent desire to continue in their job, though only thirty-one percent came into the profession because they wanted to teach. Teachers are evenly divided in their advice for girls who are considering teaching as a career; half give reasons favoring and half give reasons opposing.

Validity of the findings is supported by reference to previously published reports and studies that touch upon the same problem area and by reference to common points of strain in the organizational structure of educational systems. Implications of the study for administration and for further research are briefly treated. A translation of the provisions in the Iraqi law governing the regulations of primary schools as well as Arabic and English copies of the interview schedule are appended.

204 pages. $2.65. Mic 58-4182

AN APPRAISAL OF THE GRADUATE PROGRAM IN SCHOOL ADMINISTRATION AT INDIANA UNIVERSITY

(Publication No. 24,837)

Charles Jackson Salisbury, Ed.D.
Indiana University, 1957

Chairman: August W. Eberle

The purpose of this investigation was to appraise the graduate program in educational administration at Indiana University. To accomplish this purpose the study proposed: (1) to develop a list of the competencies needed by school administrators in this increasingly complex world, (2) to devise an appraisal instrument based on these competencies, (3) to apply this appraisal instrument to the graduate program in educational administration at Indiana University by enlisting the aid of recent graduates of the program,, and (4) to present the findings of this appraisal with recommendations for improvement of the program.

It was found in the literature that several national organizations have become actively concerned about the adequacy of pre- and in-service preparation of school administrators. Many of the institutions which offer preparation programs in educational administration have undertaken to have their programs evaluated either by their own faculty, visiting teams, or doctoral candidates.

The following procedures were used in the study:

1. Literature related to the problem was reviewed, and a tentative list of competencies needed by educational administrators was compiled from authorities in the field.
2. An interdisciplinary faculty panel assisted in revision of the list of competencies.
3. A jury of outstanding school board members, teachers, and specialists in state and county departments of education helped refine the list.
4. An appraisal instrument was developed on the basis of the refined list of competencies.
5. A pilot study was conducted for the purpose of discovering weaknesses and improving the instrument.
6. An appraisal of the preparation program in educational administration at Indiana University was made by soliciting the aid of two groups of recent graduates of the program. One group, Group I, had received the Ed. D. degree during the period 1951 to 1956, inclusive; the other group, Group II, had sufficient credits to have received institutional recommendation for the Indiana School Superintendents' Certificate during the same period.
7. The results of the appraisal were tabulated, organized, analyzed and interpreted.
8. Conclusions were drawn on the basis of the findings, and recommendations made for the improvement of the preparation program for educational administrators at Indiana University.

The following were the major findings of the investigation:

1. Those respondents who had received the doctorate generally gave the items of competency developed by their program a higher rating than the other group.
2. Of the 11 major areas of administrative responsibility used in the appraisal instrument only the area dealing with research was found adequate according to the standard used in this study. This rating was given by the group who had received the doctorate.
3. Areas showing strength were those dealing with: Use of Group Processes, Finance and School Business Management, and the School Plant: Construction, Operation and Maintenance.
4. Areas receiving lower ratings were those preparing the administrator to communicate with others, and to manage a personnel program.

The preparation program in educational administration at Indiana University tends to place emphasis on learning principles without providing opportunity for the student to apply these principles in practice. Experiences are needed in field and on-the-job situations.

The degree of competency developed, as indicated by the appraisal ratings, is dependent on the level of graduate preparation attained. Thus, continuance in the program through the doctoral level ensures the development of the competencies evaluated in the appraisal instrument to a higher degree. 197 pages. $2.60. Mic 58-4183

THE ROLE OF THE PRINCIPAL AS SUPERVISOR OF INSTRUCTION IN SECONDARY SCHOOLS OF PENNSYLVANIA CITIES WITH POPULATIONS OF 15,000 TO 50,000

(Publication No. 25,500)

John Paul Shaffer, Ed.D.
New York University, 1957

The purpose of this study of the role of the principal as supervisor of instruction in secondary schools was to determine practices actually in use in secondary schools of Pennsylvania, to determine the extent to which these current practices are valuable to the principal in his role as supervisor of instruction, and to determine areas in which the principal can increase his efficiency as supervisor of instruction by utilizing practices deemed good and not being used to their fullest extent.

The questionnaire method was used, with the investigator limiting the area of investigation to Pennsylvania cities with population from 15,000 to 50,000 and to the 70 secondary schools located within these cities. In addition to the questionnaire, the investigator personally interviewed

25 per cent of responding principals as well as six teachers in each school visited in order to substantiate questionnaire data and to obtain teacher viewpoint on the practices reported as used by principals in their roles as supervisors of instruction.

In addition to the questionnaire and the interviews, literature was extensively surveyed and intensively studied so that the reports and evaluations by the participating principals and teachers could be compared with recent thought and philosophy of the recognized authors in the field of supervision of instruction.

Analysis of the data accumulated provided statements of practices valued as highly desirable and of those which are considered valuable but are not being used to the fullest extent.

Also apparent in the data tabulated was the fact that the routine duties of managing the school often prevent the principal from spending the time he would like in the direct improvement of instruction. Only through leadership, coordination, and service can he fulfill his role of supervisor of instruction, by such means as using school personnel as staff assistants, encouraging teacher-committees actively to participate in planning and improving instruction, arranging opportunities for in-service education, providing to as full an extent as possible the teacher aids deemed valuable to classroom methods, and carefully planning and cooperatively evaluating classroom visitation.

The study also suggested important areas for further study in the field of supervision of instruction, such as free communication between principal and teacher, adequate clerical help, democratic practices throughout school organization, experimentation and its evaluation as a means of improving instruction, augmented training of the principal, perhaps to include internship prior to certification, improvement of rating through teacher self-evaluation as well as principal's "Merit" rating, through special graduate work at colleges and universities, travel, and service to the community by means of membership in clubs, activity in churches, and leadership of the community's youth.

Through tabulated results of the questionnaire and substantiating opinions and philosophy in recent literature, the investigator hopes he has presented desirable, proved practices and suggested areas for related investigation which may aid the principal of the secondary school in his role as supervisor of instruction.

189 pages. $2.50. Mic 58-4184

THE ROLE OF THE STATE DEPARTMENT OF EDUCATION IN THE PUBLIC SCHOOL GUIDANCE PROGRAM

(Publication No. 25,031)

Clarence Talmadge Sharpton, Ed.D.
University of Kentucky, 1951

All forty-eight states have agencies to promote public educational activities in local communities. One area of service offered relates to the guidance of children. This study seeks to investigate, analyze, and define those guidance services in most common use today among the states and to determine to what extent and in what areas the state department is obligated in making them available to public schools.

Data used here were obtained principally from two sources. A critical analysis of the literature in the field of guidance contributed substantially toward that portion dealing with the background to organized guidance. A questionnaire was sent to each chief state guidance official or chief state educational officer with forty-four responding in time to be included. Ten of the forty-four respondents stated that statewide guidance services are not provided leaving only thirty-four states represented in these data on current guidance organization, administrative and supervisory practices at that level.

Certain factors were found to have exerted great influence on the organized guidance movement. Among them were the following: pioneering educational leaders, outside agencies, committee and commission studies, the press and the Federal Government. No attempt was made at a quantitative evaluation of these factors.

Among the several conclusions arrived at through this study, the following appear to be most significant: there is a need for further research in this area and there is an increasing interest in state level guidance programs. Most of the states have guidance programs but there is wide variance in procedures followed and practices utilized. State guidance directors were about evenly divided on the concept of guidance as a service to be provided by specialists and that of guidance to be provided by regular teachers. The administrative head of the statewide program is a full-time job in most states and about two-thirds of them do not have tenure. In all but one state, he is appointed by the chief state school officer. Most of the states require a minimum of three years teaching experience as a prerequisite to holding the chief state guidance position.

Approximately two-thirds of the states include elementary schools in the statewide program and twenty of the thirty-four states make their services available to out-of-school youth. Wide variance exists among the states as to the number of other agencies with which guidance is coordinated although all but two provide consultative services through the statewide plan.

The trend is away from offering occupational information as a subject-matter course and there is a lack of sufficient guidance publications made available to schools by the state agencies.

Only forty per cent of the states prescribe a standardized pupil personnel record system and less than one-third of the states include testing as a part of the statewide program.

There is a critical shortage of adequately-trained guidance personnel and eighty-five per cent are attempting in-service programs to meet this need. Also, there is a trend toward counselor certification.

These and other recommendations resulted from the study: that the state departments adopt a more active policy toward guidance to provide services consistent with those in other areas even though this might necessitate a reorganization of the department; that a staff guidance committee be appointed by the chief educational officer to coordinate and promote guidance activities; that the chief state guidance officer devote full time to guidance functions; that where Federal funds are utilized, they not be restricted to narrow guidance usage.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Based upon needs of the state, a basic curriculum be adopted for training counselors and guidance personnel leading toward special certification.

112 pages. $2.00. Mic 58-4185

HIGH-SCHOOL EDUCATION FOR NON-COLLEGE YOUTH: A critical survey of educative experiences that contribute to a "more realistic and practical program of education" for non-college youth in New York State Central Schools, and implications from the findings for the readjustment of high-school education.

(Publication No. 24,190)

Howard George Shineman, Ed.D.
New York University, 1957

Problem

The purpose of this study was to make a critical survey of educative experiences that contribute to a "more realistic and practical program of education" for non-college youth in New York State Central Schools, and to draw implications from the findings for the readjustment of high-school education.

This involved: choosing criteria for characterizing appropriate educative experiences for non-college youth in academic high schools, selecting the most appropriate types of experiences to include in the curriculum, surveying the current status of these and other offerings in selected New York State Central Schools by questionnaire and field studies, and analyzing the pertinent data to find if there were implications for the readjustment of education for these youth.

Procedure

A group of professional educators were asked to revise, clarify, or add to a tentative list of criteria and to propose appropriate educative experiences. Educators and laymen from the field expanded the proposals. Committees of teachers from the cooperating schools gave their opinions concerning which were the most appropriate, which were provided to a promising extent or neglected at their schools. They, and the principals, gave other descriptions of the curriculum and opinions concerning more realistic education for non-college youth. Three schools were selected on the basis of the appropriateness of their offerings for field studies. From the pertinent findings and implications, a tentative framework of a curriculum for non-college youth in academic high schools and other recommendations were proposed by the investigator.

Findings and Implications

Educative experiences that were chosen as most appropriate indicated the opinion that the curriculum for these youth should give attention to immediate problems, life concerns, and opportunities to practice the useful skills in real situations. These needs suggested an activity approach with some form of block scheduling. The development of responsibility and the fundamentals of reading, speaking, spelling, and arithmetic were to be emphasized, perhaps in the junior and senior years, and supplemented with on-the-job training.

No single educative experience was chosen as especially appropriate by more than a third of the respondents. Its appropriatness might, however, be considered in terms of the difference of degree or extent to which it is provided or of the emphasis that is placed on it in lieu of other requirements in the curriculum.

The need for leadership, in-service education, participation of all affected in efforts of curriculum reorganization and/or revision, a willingness to break with tradition in curriculum experimentation, and larger centralizations or intermediate units were indicated.

It was evident that curriculum reorganization and/or revision had not proceeded very far in the past ten years in the cooperating Central Schools. A county-wide cooperative trades program, observed in the field studies, gave realistic learning experiences to non-college youth. Considerable grouping was practiced, but there was little evidence of differentiated experiences. More imagination will be needed to provide a truly "realistic and practical program of education" for these youth.

Recommendations

The findings and implications pointed to a core type of curriculum for half a day. The other half day would be devoted to vocational or business subjects and/or a cooperative trades or on-the-job training program.

The chief needs to be achieved with appropriate educative experiences seemed to be those concerned with youths' immediate problems and life concerns, the arousal of vocational interest and discovery of vocational aptitude, practical vocational training and the development of some marketable skill, emotional health, and opportunities to practice the useful skills in real situations.

298 pages. $3.85. Mic 58-4186

THE FORMULATION, CONTENT, AND USE OF WRITTEN SCHOOL POLICIES OF MISSOURI BOARDS OF EDUCATION

(Publication No. 24,493)

Newman Milburn Walker, Ed.D.
George Peabody College for Teachers, 1957

Major Professor: Erick L. Lindman

The purpose of this study was to survey and analyze Missouri school boards' practices relating to the formulation, content, and use of written school policies. Data were obtained through these procedures: (1) Questionnaires were sent to a 20 per cent random sample of Missouri school superintendents. (2) Questionnaires were sent to all Missouri State Department of Education district supervisors. (3) Tape recordings of fifteen Missouri School Boards Association meetings, at which discussion pertained to written policies, were audited. (4) Forty policy handbooks of Missouri school boards were examined. (5) Related literature was summarized and writers' opinions were synthesized to develop principles of effective formulation and use of written policies.

Strengths and weaknesses of written policy practices of Missouri school boards were determined. Recommendations were made to correct weaknesses which were

found. Sample statements from policy handbooks were presented to illustrate typical Missouri school board policies.

Findings

Professional literature reflected greatly increased interest since 1950 in written school board policies. Legal opinion stressed that courts will not ordinarily interfere with school board policy actions unless: (1) the board has enacted policy which is not within its jurisdiction, or (2) the board has acted arbitrarily or unreasonably in implementing policy.

In 1949, Missouri became the first state to require use of written policies as a prerequisite to school system accreditation. As a result, over 90 per cent of Missouri school boards use written policies.

School staff or lay groups participated in written policy development in 65.6 per cent of Missouri school districts. Only one-fourth of the handbooks included a table of contents or index. The handbooks contained an average of thirty-five policy topics and were usually ten to twenty-five pages in length. Seventy-five different policy topics were found, each of which was included in three or more handbooks.

Most school boards revised their written policies by regular voting procedure. Usually, no attempt was made to revise handbooks already in use. Larger school systems utilized written policies more effectively than smaller systems. Superintendents, board members, and Missouri State Department of Education officials gave overwhelming approval to the benefits of written policy use.

Among the principal strengths of written policy practices were:

1. Written policies clarified duties of board members and employees and served as guides to action.
2. Written policies saved time for the board and administration.
3. Written policies were an effective orientation device for new board members and employees.
4. Written policies provided stability, continuity, and consistency for the school program.
5. Written policies united board members and increased teamwork among school personnel.

Among the principal weaknesses of written policy practices were:

1. Written policies were often formulated perfunctorily. Policies were developed with insufficient participation of school personnel and lay groups.
2. Most policy handbooks were poorly organized, not comprehensive, and lacked reference aids for users.
3. Distribution of policy handbooks was often inadequate.
4. Written policies were usually not kept up-to-date.
5. Written policies were often disregarded by school employees and board members.

Recommendations

Recommendations to improve written policy practices of Missouri school boards included: (1) measures to obtain increased staff and lay participation in policy development, (2) techniques to improve handbook design and distribution, (3) procedures for efficient policy revision, and (4) methods of policy implementation and evaluation.

Specific procedures were recommended to the Missouri State Department of Education, Missouri School Boards Association, Missouri Association of School Administrators, and Missouri State Teachers Association by which they could encourage Missouri school boards to improve written policy practices. 231 pages. $3.00. Mic 58-4187

A CRITICAL ANALYSIS OF THE SPARSITY AND WEALTH FACTORS OF THE INDIANA PUPIL TRANSPORTATION SUPPORT FORMULA

(Publication No. 24,841)

Charles Wells, Jr., Ed.D.
Indiana University, 1957

Chairman: W. Monfort Barr, Ed.D.

The purpose of this study was three-fold: the validation of the use of linear density (or its inverse, sparsity) of legally transported pupil in the predication of the expenditure per transported pupil in the Indiana transportation support formula enacted in 1955 and the empirical derivation of new sparsity and wealth factor values for use with this formula; the derivation of an alternative method of estimating the reasonable cost of pupil transportation; and the development of a new transportation support formula based upon this new method of estimating the reasonable cost and also providing for equalization in determining the state support for pupil transportation.

Data were collected for all of the 1,072 Indiana school corporations (districts) legally able to transport pupils, on ownership of busses, number of pupils transported daily, number of pupils living more than the maximum walking distance from school, daily bus mileage, wealth per resident pupil, total expenditure for pupil transportation, and the transportation support paid by the State of Indiana in 1955-1956. These data were separated into three parts on the basis of school bus ownership: public, mixed public and private, or private. A statistical analysis was made of the data; the correlations between the variables logarithm of linear density, wealth per resident pupil, and logarithm of expenditure per transported pupil were determined, and the multiple correlation between these three variables was determined.

It was found that: There is an inverse, hyperbolic relationship between linear density and the expenditure per transported pupil, with a correlation of approximately -0.64. In Indiana the mean linear densities of the three bus ownership groups were not significantly different, yet the average expenditure per pupil per year in those school corporations having all busses publicly owned was $18 more than in those having all busses privately owned. Wealth factor values, intended to equalize the support, cannot be determined empirically, while the expenditure per transported pupil can be predicted from linear density by means of a regression equation. A multiple regression equation can be set up for predicting expenditure per transported pupil from linear density and wealth per resident pupil. Equalization of pupil transportation support can be achieved by the use of a formula for computing the equalization on the basis of the wealth per legally transported pupil in the school corporation.

Conclusions based upon the findings were: Linear density is as valid for the prediction of the reasonable cost of pupil transportation as is any other single measure not in use; a regression equation can be used to establish sparsity factor values for use with the Indiana pupil transportation support formula; wealth factor values must be set up by a priori methods. The reasonable cost of pupil transportation can be estimated for all Indiana school corporations by means of a multiple regression equation based upon linear density and wealth per resident pupil and derived from data for that group of schools owning all busses and thus having significantly lower costs. A satisfactory new state transportation support formula can be developed by combining this reasonable cost equation with a formula for equalization which determines the equalization of the support from the local wealth per legally transported pupil.

It was recommended that the State of Indiana support the entire estimated reasonable cost of pupil transportation (requiring an annual appropriation of approximately $9,000,000 per year) or that it bear the major part of the support, with each school corporation's equalization being computed from the local wealth per legally transported pupil. 308 pages. $3.95. Mic 58-4188

ARTICULATION PROBLEMS PERCEIVED BY HIGH SCHOOL FRESHMEN

(Publication No. 25,363)

Richard Harrison Williams, Ed.D.
Stanford University, 1957

This study is concerned with identifying the problems which tend to impede the progress of the entering high school student. One method by which pupil progress can be examined is to have the freshmen students identify their perceptions as to the problems they face as they experience the period of transition from one educational unit to another. Not only were the perceived problems of articulation identified in this study, but the relative seriousness of each problem was also determined.

The problems of articulation were analyzed with reference to each sampled high school, each high school and its contributing district elementary schools, the sex of the respondents, and elementary schools with a shared high school superintendent and elementary schools without a shared high school superintendent.

The subjects were all freshmen students of the selected four high schools in Santa Clara County, California, and who met the specific requirements of the study. Randomly selected second semester freshmen students were interviewed for their perceived problems of articulation until, in each school, twenty-five were found who volunteered problems. The interview responses were categorized into eleven articulation problem areas and then organized into a paired-comparison check list which was administered to all the freshmen students in the four high schools. Each student answering the check list indicated for each of the fifty-five pairs of problems the one that he judged "more serious."

The perceived articulation problem areas categorized from the responses of the interviewed freshmen students were the following: "worried about hazing," "making friends and getting acquainted with other students," "getting to know a greater number of teachers," "selecting courses and subjects," "getting used to increased amount or difficulty of homework," "getting used to less teacher prodding," "finding the different rooms," "getting used to the schedule of classes," and "getting used to the passing time between periods."

The freshmen students perceived the following four problem areas as being markedly more serious: "getting used to increased amount or difficulty of homework," "selecting courses and subjects," "getting used to different teachers using different teaching techniques," and "getting used to attendance rules and procedures."

The relative intensity of the articulation problem areas seems to have been influenced by population of the respondents' high school, sex of respondents, and the elementary school from which the respondents graduated. Students from the larger high schools perceived their more serious articulation problem areas as having greater relative intensity than students from the smaller high schools. The results suggest that the size of a high school does not affect the rank order of seriousness of problem areas but that the size does affect the degree of perceived seriousness. Females perceived their more serious articulation problem areas as having a greater relative intensity than males. The results indicate that although girls perceive the problem areas in the same rank order as do boys, girls judge the problems relatively more serious than to the boys. Some of the elementary school groups differed markedly as to the relative intensity of the more serious perceived articulation problems. Different elementary schools, therefore, seem to have a different effect on the relative intensity of the perceived articulation problems.

Perceived problems of students from schools having a common administrative head over both elementary and high school groups did not differ from those in schools that had two different administrators. Articulation problems were not affected to any significant degree when the two types of administrative structures were compared.

The researcher believes that the complex area of elementary-secondary articulation is important enough to warrant continued interest and research.

113 pages. $2.00. Mic 58-4189

RELATIONSHIP OF HIGH SCHOOL SIZE TO CURRICULAR OFFERING

(Publication No. 25,364)

Thomas Edward Woods, Ed.D.
Stanford University, 1957

Problem

Since World War II, many communities have needed additional high schools. In the planning for these high schools, secondary educators have been asked to recommend the high school size which can best provide an adequate educational program.

The optimum size of a high school has never been satisfactorily determined. Since the many factors to be considered in a determination of optimum size could not

be adequately examined in one study, four co-operative studies were undertaken to determine the relationship of high school size to curricular offering, guidance, staff relations, and school community relations. The concern of this study was the curricular offering.

Procedures

Four questionnaires, each of which contained items pertinent to the area of curriculum, were administered to a random sampling of different populations within seventeen four year high schools in the Bay Area of California ranging in enrollment from 800 to 2,000 plus. The samplings included ten per cent of the parents of the high school students, all administrative officers, fifty per cent of the teachers, and ten per cent of the students.

The schools were divided into four categories according to size: 800 to 1199, 1200 to 1599, 1600 to 1999, and 2,000 and above. Two types of analyses were made: (1) a Chi square test was used to determine any significant differences in responses to each of the items in the questionnaires among the schools of a particular size category, and (2) the test for significance of difference of per cent was used to determine if there were significant differences in responses among the schools of different size categories.

The data from the administrators form did not lend itself to this type of treatment due to the small number of respondents, five or less for each of the schools. These data were grouped by size category and inferences made by inspection of the data.

The data were examined to determine the relationship between size of high school and eight specific factors related to curricular offering.

Results

No consistent relationship emerged between size of high school and any of the following factors: availability of curricular offering, parental participation in the student activity program, and student reaction to the activity program.

The smallest size schools in the enrollment range of 800 to 1199 tended to

1) be less effective in communicating with parents and students concerning the curricular offering.
2) provide fewer materials of instruction.
3) make less provision for curriculum development.
4) be less efficient in organizing and administering the activity program.

The most favorable parental reaction to the curricular offering was found in schools in the 1200 to 1599 enrollment range. The differences were consistent and in most cases significant at the five per cent level or better.

Conclusions

The lack of consistency of response of schools within the same size category and among size categories suggests that size of high school is not a limiting factor with respect to those phases of the curriculum studied. The number of unfavorable responses tended to be most numerous for schools in the 800 to 1199 enrollment range. Size may be a limiting factor for schools below 1200 with respect to materials of instruction, parent and pupil awareness concerning the curricular offering, organization and administration of the activity program, and curriculum development.

Within the limits of the data gathered in this study, the arguments that larger schools tend to lose sight of the individual needs of youth and deny to many the opportunity to participate in student activities do not appear to be valid. 152 pages. $2.00. Mic 58-4190

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

EDUCATION, ADULT

ADULT EDUCATION IN KENTUCKY

(Publication No. 25,036)

Chester Coleman Travelstead, Ph.D.
University of Kentucky, 1950

The objectives of this study are (1) to determine adult education needs in Kentucky; (2) to survey the outstanding programs of adult education in Kentucky; and (3) to make recommendations for needed expansion and changes in these programs in order to meet needs not now being met.

The scope and limitations of the study may be described as follows: (1) emphasis is placed on the tax-supported adult education programs at the state level; (2) no attempt is made to consider ways and means to finance any of the present or proposed adult education programs; and (3) although recent data is used whenever possible, some statistics used are several years out of date.

The writer conceives of the functions of adult education as being as follows: (1) to fill gaps in previous schooling; (2) to meet vocational needs; (3) to provide exploratory experience and instruction for the purpose of widening interest and knowledge; (4) to develop recreation and self-expression; (5) to promote health and safety; (6) to facilitate adjustment in family relationships; (7) to provide opportunities for social adjustment within a group; (8) to improve citizenship; and (9) to prepare adults for social and industrial change.

The problems which reveal the need for adult education in Kentucky are as follows: (1) problems related to general population changes; (2) problems related to personal and family living; (3) problems related to vocational requirements; (4) problems related to the use of natural resources; (5) problems related to public health and safety; (6) problems related to economic status; (7) problems related to civic responsibilities; (8) problems related to general culture and formal education.

Many of the adult education programs being conducted by local, state, and federal agencies in Kentucky are described and partially evaluated. The agencies so studied are as follows: (1) Kentucky State Department of Education; (2) Kentucky State Department of Welfare; (3) Kentucky State Department of Health; (4) Kentucky State Department of Conservation; (5) Kentucky Division of Game and Fish; (6) Kentucky Department of Mines and Minerals; (7) Kentucky Geological Survey; (8) Kentucky State Department of Highways; (9) Kentucky State Department of Library and Archives; (10) University of Kentucky; (11) State Colleges; (12) University of Louisville; (13) Local Agencies; (14) Federal Agencies.

The writer recommends that the State of Kentucky, in order to accomplish more effectively the objective of meeting adult education needs not now being met, do the following:

1. Coordinate more effectively through a State Council on Adult Education the adult education programs within the state.
2. Reorganize the Kentucky State Department of Education to include a division or bureau of adult education.
3. Establish certain additional agencies and bureaus to facilitate a richer and more extensive program of adult education. Such action would include an enrichment and broadening of the adult education programs of the University of Kentucky and of the state-supported colleges, as well as a greater educational opportunity for the "educated adult" in Kentucky by designing adult education programs to challenge not only the illiterate and the high school graduate but the college and university graduate as well.
4. Increase the appropriations by the Kentucky State Legislature for various agencies to be used in the expansion of the adult education program.
5. Encourage greater effort at the local level in meeting the educational needs of adults. Such action could be brought about to some extent by encouraging and developing the programs of "community schools" throughout the state.

434 pages. $5.50. Mic 58-4191

EDUCATION, HISTORY

THE SOCIAL STUDIES CURRICULUM IN THE SECONDARY SCHOOL: 1893-1955

(Publication No. 25,347)

Andrew Norman Cruikshanks, Ed.D.
Stanford University, 1957

This is an historical study which traces the development of the social studies curriculum in the American secondary school from the "separate subject" approach of the 1890's to the present "field" organization. It identifies the accretion of new elements now embodied in the social studies. The primary concern is with changes in content and emphases rather than with organizational patterns and methodology. Some relationships between the curriculum and social changes are indicated.

The study assumes that the nature and extent of changes in curriculum content may be determined by the analysis of authoritative literature, laws and ordinances, representative textbooks, and selected courses of study. Data are presented chronologically in four periods: (1) 1893-1915; (2) 1916-1930; (3) 1931-1940; (4) 1941-1955.

The period 1893-1915 was one of relative stability, with the content of the curriculum largely determined by national committees of social scientists, most of whom were historians. During this period "civil government" became "civics"; while geography, which had been largely physical geography, shifted to a newer "commercial geography." By 1915 economics was offered in almost one third of the high schools, while sociology was making its first appearance.

The period 1916-1930 was one of transition from stability to experimentation and expansion. National committees exerted less control over the curriculum, while the influence of educators was growing. The term "social studies" was widely used by 1930. "Fusion" and "unified" courses appeared, and there was a great increase in the use of scientific methods for the selection of content. Civics became more functional, while history textbooks

placed more emphasis on recent historical periods. Commercial geography and economics increased in the frequency of offerings, and the twelfth-year "problems" course was introduced. By 1930 laws in 39 states required the teaching of the federal or state constitutions, or both.

The period 1931-1940 marked the end of the dominance of national committees, and such recommendations as were made by national organizations were general in nature. The curriculum continued to expand and disagreement on content was widespread. Textbooks tended to become less descriptive and more functional. Fusion and unified courses increased in frequency, but these were seldom found beyond the ninth grade. Needs and interests of students and communities received more attention, and materials on personal problems were introduced into social studies courses. New courses included international relations, consumer education, and Pacific relations. New topics included safety, public opinion, the consumer, culture, city planning, and propaganda analysis.

The period 1941-1955 was one in which proliferation of courses and topics continued. Citizenship education received a large share of attention, and several states initiated state-wide studies and experimental programs. As American history and world history courses increased in frequency and enrollments, English history and ancient history had almost disappeared. "Air age" and "global" geography enjoyed a brief period of popularity during the war years. History and civics textbooks placed more emphasis on international relations. Personal needs of students received more attention, and guidance became an established part of the social studies. Driver education and first aid courses and units appeared, while marriage and divorce as well as alcohol and narcotics were found in a number of courses of study. Wide disagreement over scope and sequence continued, and the problems of articulation were unsolved.

Cause-and-effect relationships were difficult to discern. Such social problems as were considered by textbooks and supplementary materials tended to be descriptive and almost wholly "conservative" in nature. Throughout the period 1893-1955 there was much evidence to suggest that textbooks were the major determinants of the curriculum.

263 pages. $3.40. Mic 58-4192

THE JUNIOR MUSEUM AND ITS PROGRAM FOR THE EDUCATION OF CHILDREN

(Publication No. 25,348)

Francis Clair Gale, Ed.D.
Stanford University, 1957

Statement of the Problem

The purpose of this study was to investigate the aims, organization, and functions of the junior museum throughout the United States; particularly its relation to the education of children.

Procedure

Letters were sent to the directors of the 87 junior museums in the United States with a request for their cooperation in this study. A questionnaire was sent to the 55 directors who expressed a willingness to participate in the investigation. The returned questionnaires were tabulated and analyzed under the following headings:

Origin and Development of the Junior Museum
Method of Organization
Financial Support
Location, Housing, and Facilities
Program
Staff
Factors in Museum Attendance
Relations with Community
Relations with Schools
Relations with National Foundation for Junior Museums
Relation to the Education of Children
Problems of Junior Museums

Major Findings

Most junior museums were independently housed, but the facilities of the majority were considered inadequate.

The average annual budget of junior museums was about $11,000 (in 1955), with approximately 40 percent used for operating expenses exclusive of salaries.

Museum objectives corresponding to those of the elementary school were in the areas of the social world--development of the individual for social responsibility; and physical world--knowledge of plants and animals, nature, science, conservation, machines, etc. The junior museum objectives agreed with those of schools only moderately.

Although social science and cultural history was ranked first in subject areas included in programs (in 1956), relatively few junior museum activities were related to this area. The training of the museum directors, identified through college courses, was lowest in social science and cultural history.

Subject areas included in the program did not depend upon the directors' training as much as upon the availability of materials and the efforts to supplement offerings of schools.

While the programs of junior museums were generally directed toward or coordinated with programs of the local schools, the schools exercise only moderate control over museum programs.

Relation to the Education of Children

Junior museum personnel feel that the major contributions of their programs to the education of children are: (1) the establishment of interests in the subject areas of natural history, social science and cultural history, physical science, and arts and crafts; (2) development of new understandings and appreciations; (3) establishment of hobbies; (4) training in accurate observation; and (5) providing special opportunities for the gifted, the retarded, and the handicapped child.

The survey showed that junior museum personnel strive through the use of visual materials to give form and substance to abstract ideas and symbols in teaching about the natural environment and about peoples. Materials--and helpful suggestions regarding their use in programs--are given by junior museum personnel to schools, youth organizations, clubs, and churches. Junior museums provide

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

guidance and an atmosphere of freedom in which children can more easily pursue individual interests. They try to stimulate children to develop initiative in achieving knowledge and understanding; and new interests and appreciations. They seek to create situations in which children are led to desirable changes in attitudes and behavior. Contacts with junior museums have frequently led children to a choice of life vocation.

Most of the directors who expressed needs were generally agreed that the benefits and services of their junior museums could be increased materially if their problems of housing, facilities, money, and personnel could be solved.

198 pages. $2.60. Mic 58-4193

THE DEVELOPMENT OF THE JUNIOR COLLEGES IN VIRGINIA

(Publication No. 24,483)

Donald Crittenden Pearce, Ed.D.
George Peabody College for Teachers, 1957

Major Professor: Roosevelt Basler

This study traces the development of the junior colleges in the state of Virginia. It covers a time span of just under one hundred years--from 1853 to 1950. Twenty schools are included. Each school is handled individually on the basis of certain characteristics which differentiate the schools as a type. The study follows a chronological sequence, being divided into chapters which correspond closely to well defined eras of development. Factors on the broader scene which brought about change in the schools studied are included in each chapter. General summaries conclude each chapter and a general summary concludes the study. Source materials include college catalogs, yearbooks, board minutes, denominational records, personal interviews, school histories, newspapers, and government publications.

Findings of the Study

The junior college, in Virginia, was a creation of the Virginia State Board of Education. In 1912, this agency set up standards for classifying all institutions of higher education in the state. The public schools had expanded rapidly since 1903 and strict certification requirements for teachers were a necessity. Before it could certify the preparation of its teachers the Board had first to classify the schools engaged in teacher training. Certain schools were unable to attain a four-year rating under the standards set up. For these schools a "junior college" classification was evolved. It included, at the outset, eleven so-called colleges, institutes, and seminaries. The number increased to thirteen in the years before 1929, the composition changing with new schools being founded and old ones being closed. In 1950, the year in which the study closes, there was the same number of junior colleges as had existed in 1912.

Although an act of the State Board of Education officially created the junior college, the type had been emerging for many years. It had consisted, for the most part, of church related female seminaries. These schools offered the full range of education from first grade through college. They were small, meagerly equipped and meagerly staffed. Their financing was precarious. They operated, primarily, on the income from student fees. Regular enrolment rarely exceeded 150 and the annual cost to students was modest, even in the more expensive schools of the type. Many extra fees were charged for "special" subjects.

For many years, dating back as far as 1875, these female seminaries had constituted a problem for the more reputable standard colleges. They demanded inclusion among institutions of higher education. Their catalogs offered the full range of college courses and they were entitled by their charters to confer degrees. Not until 1900 did the growing tide of educational change force upon these so-called colleges a reconsideration of their status and function. When they attempted, as they belatedly did in the decade before 1912, to cooperatively elevate their standards, they discovered that their resources were too modest for the times. The pressure from the high schools below and from the standard colleges above was dooming them to extinction. The action of the State Board in setting up a junior college classification gave the schools new hope and new purpose.

The years between 1912 and 1925 were years of standardization. Depression and war followed and in 1950 the junior college remained an integral, though not outstanding, part of the educational system of the state. The schools were small, exclusive, and aristocratic. Apparently, the democratic extension of education would not be carried out by them in the future. 378 pages. $4.85. Mic 58-4194

EDUCATION, PHYSICAL

RECREATION AND THE AGING PROCESS

(Publication No. 23,711)

James Anton Baley, Ph.D.
The Ohio State University, 1952

There has been, in recent years, increasing concern over the growing numbers of older people and the social and economic problems which they present. Edward J. Stieglitz points out through predictions from the census that even though our country now has a serious economic problem in supporting its incapacitated old people, the problem will grow tremendously in the next forty years.[1]

Studies of the 1940 census reveal that while the population of the United States as a whole increased 7.21 per cent over 1930, the number of persons aged sixty-five or over increased 35 per cent. In 1940 there were approximately 9,000,000 people sixty-five years of age or older in this country. Theodore Klump, member of the National Social Welfare Assembly and conference chairman of its National Committee on the Aging, predicted that in less than thirty years approximately 24,000,000 people in the United States will be aged sixty-five or older.[2]

While the number of people over sixty-five will have increased 100 per cent, the rest of the population will show only a 20 per cent gain.

These figures mean that the burden of support will fall

upon a considerably smaller segment of the population unless society learns to sustain and to utilize the productive abilities of older men and women.

However, statistics show that elderly people are not at all healthy as a group. A man in his forties or fifties disabled for years by arthritis or cerebral, peripheral, or coronary arteriosclerosis is a far greater social loss and a heavier burden upon his immediate family and society as a whole than a man who dies immediately. The cost of the chronic diseases of middle and old age must be measured by more than mortality tables.

An increasing number of professional individuals and groups are becoming interested in the personal, social, and economic problems associated with an aging population. Almost all the approaches to this problem have been from the standpoint of preparing the individual psychologically and economically for his remaining years of usefulness. Social security measures provide the individual with a minimal standard of living. The social and psychological approaches emphasize the problems of readjustment. The medical approach focuses upon relieving pain and enabling a survival level of physical efficiency. Few studies have emphasized the establishment of health and recreational habits which would sustain an individual's mental and physical health at a high level until relatively advanced age.

The establishment of proper recreational habits promises a partial solution to the problem of sustaining mental and physical fitness. Several studies have shown that middle-aged men, like younger men, can improve their physical fitness in such matters as muscular strength, power and endurance, agility, and cardiovascular and respiratory efficiency through a program of progressive physical exercise.[3,4,5] A number of psychologists and psychiatrists writing on the mental and psychological problems of older people point out that the tensions, conflicts and emotional strains which are concomitants of a complex civilization can and do cause a number of physical ailments such as hypertension, cardiac troubles, and ulcers. They emphasize the important part recreational habits play in relieving these tensions and conflicts.

However, people will not engage in recreation requiring physical activity solely on the grounds that there is convincing evidence that it will "do them good." There must be an attempt made to study ways to change their recreational patterns, for, in the main, those patterns are determined largely by habit. The way a man spends his leisure time at the age of thirty is an important factor in determining how he will spend it at the age of forty. Therefore, men's recreational lives must be viewed as a continuum.

The Problem

The study attempts to take a step in the direction of finding ways of changing the leisure-time pursuits of adult men by discovering the recreational habits and interests of men at various age levels. The following are some of the objectives of the study:

1. To determine how men at the various age levels spend their leisure time
2. To determine in what activities men would like to participate
3. To determine the discrepancies between men's recreational habits and desires
4. To determine men's reasons for not participating more frequently in those activities in which they desire more frequent participation
5. To determine what activities are participated in most frequently by men of each of four age groups (20-29, 30-39, 40-49, and 50-59).
6. To determine what activities are liked by the greatest proportion of men of each of four age groups
7. To determine the changes in recreational habits from decade to decade
8. To determine the changes in recreational interests from decade to decade
9. To determine what activities, if any, men find enjoyable at all ages
10. To determine the relative constancy of appeal of the various recreational activities from one age group to the next
11. To determine the relationship of recreation to income.

Limitations

1. The bulk of the responses to the questionnaire were secured from one industrial plant in Cleveland, Ohio, which did not sponsor a recreational program for employees. The results might have been different if the company had had such a program. However, since most industrial companies do not have a recreational program, the recreational habits and interests of men employed by this company are undoubtedly more representative than those of men employed by companies with well-organized recreational programs.
2. It would have been desirable to include more responses from men of the upper- and lower-income groups (0-$2,000 and over $7,000). Statistically the findings with respect to these two income groups can be regarded as only suggestive.
3. When planning recreational programs for adult men, the recreational habits and interests of these men are only two factors which must be considered. Other factors would be facilities available, funds, competencies of the recreational leaders, and factual evidence regarding what is best for the men.

Methods of Procedure

The procedures utilized in this study were as follows:

1. Synthesizing selected writings and studies in fields related to physical education and recreation (principally sociology, psychiatry, and geriatrics) and adapting the principles discovered to the field of physical education and recreation to serve as guides for the conduct of recreational programs for middle aged men. One-hundred twenty articles and sixty books were selected for review.
2. Discovering the recreational interests and habits of adult men between the ages of twenty and sixty by means of a recreational questionnaire covering sixty-seven recreational activities administered to approximately three thousand men residing in seven

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cities of varying size (Cleveland, Columbus, and Delaware, Ohio; Butler, New Castle, and Slippery Rock, Pennsylvania). These men were engaged in a variety of occupations and represent a wide income range.

3. Talking with retired and middle-aged men concerning their leisure time and recreational interests and problems.
4. Corresponding with gerontologists and other professional people interested in the problems of aging.

The recreation questionnaire was the principal tool of the study. This questionnaire asked men to indicate their attitude toward participating in each of sixty-seven recreational activities by placing a check mark in one of three columns headed "like," "dislike," and "indifferent." They were also asked to indicate the frequency of their participation in each of these activities and, if they were prevented from participating as frequently as they would like, what the reason for this was: health, lack of time, lack of funds, lack of facilities, lack of knowledge and skill, etc.

The Cleveland Pneumatic Tool Company was kind enough to coöperate in this study. The bulk of the responses to the questionnaire were secured from this firm with the generous and untiring assistance of its labor relations man, Ernest Molnar. All 2,000 employees, both office and factory, and at all echelons, were polled. An additional 1,000 questionnaires were completed by residents and business people of Cleveland, Columbus, and Delaware, Ohio; and of New Castle, Butler, and Slippery Rock, Pennsylvania. These cities range in size from Slippery Rock, Pennsylvania, with a population of approximately 1,000, to Cleveland, Ohio, with a population of over 1,000,000. The faculties of Ohio Wesleyan University and Slippery Rock State Teachers College were polled. Members of the Golden Age Group of the Central Community House in Columbus, Ohio, were also interviewed. From these groups 411 useable questionnaires were secured. Many of these workingmen did not fill out the form completely. They indicated their attitude toward the activity but did not indicate the frequency of their participation. Since the writer planned to relate frequency of participation to percentage liking each activity, it was necessary to discard those forms not filled out completely.

For tabulating purposes, the questionnaires were sorted into the following four age groups: 20-29 years, 30-39, 40-49, and 50-59. After all useable questionnaires had been tabulated for age groupings, they were re-sorted and tabulated according to the following six income groupings: 0-$2,000 annually; $2,000-$3,000; $3,000-$4,000; $4,000-$5,000; $5,000-$7,000; and over $7,000.

Summary and Conclusions

I. As men grow older they like fewer recreational activities, feel indifferent towards an increasing number, and dislike an increasing number.

   A. There are seven sedentary activities which are liked by an increasing number of men from each succeeding age group. These are:

      1. Checkers
      2. Still fishing
      3. Card playing
      4. Listening to the radio
      5. Watching television
      6. Reading
      7. Stamp collecting

   B. It should be noted that the activities which become increasingly popular with increasing age are of a sedentary nature and are engaged in by one person alone or by only a few people.

   C. There were six activities which showed an insignificant decline in interest with increasing age. These were:

      1. Bowling
      2. Bait casting
      3. Motoring
      4. Puttering and repairing
      5. Visiting friends
      6. Watching sports events

   D. The following is a ranking of activities according to the over all decrease in the percentage of men indicating that they liked them. (It should be kept in mind that a high proportion of men from the 20-29 age group like some of these activities while only a small proportion of men from this age group like others. This means that the former group of activities can show a greater decrease in popularity over the total age span and yet be liked by a greater proportion of men in the 50-59 age group.) The listing follows.

1. Table tennis	28. Chess
2. Swimming	29. Painting
3. Touch football	30. Sailing
4. Volleyball	31. Handball
5. Social dancing	32. Archery
6. Softball	33. Wood-carving
7. Badminton	34. Calisthenics
8. Dating	35. Water polo
9. Ice-skating	36. Hunting
10. Baseball	37. Conversing
11. Basketball	38. Bag punching
12. Canoeing	39. Walking
13. Roller-skating	40. Horseshoes
14. Night-clubbing	41. Watching sports
15. Golf	42. Deck tennis
16. Horseback riding	43. Bowling
17. Gymnastics	44. Visiting friends
18. Skiing	45. Bicycling
19. Music	46. Tumbling
20. Boating	47. Woodworking
21. Social drinking	48. Hiking
22. Weight-lifting	49. Fencing
23. Tennis	50. Puttering and Repairing
24. Movies	51. Square Dancing
25. Metalcraft	52. Speedball
26. Photography	53. Still-fishing
27. Ice hockey	54. Bait-casting

Note: Tumbling, fencing, and speedball show little decline in popularity principally because they start out with a low degree of popularity.

The three types of activities which show the greatest decline in popularity are (1) those which require quick reaction time, (2) those which require physical stamina and endurance, and (3) those which satisfy the romantic and erotic impulses.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

II. The rank of activities according to the proportion of men liking them is approximately the same for all six income groups.

A. Apparently men become more individualistic in their recreational likes and dislikes as their income increases, since the percentage of men liking each activity ranking first, second, third, or twentieth becomes smaller for each succeeding income grouping.

B. The popularity of a few activities seems to be related to income.

1. The percentage of men from each income group who enjoy conversing increases with each succeeding higher bracket.

2. The probability that a man will enjoy card-playing increases with income.

3. Activities which provide social contacts are liked most by men from the highest-income group (above $7,000).

4. Men of the $5,000-$7,000 income group like the sports types of recreational activities more than do men of any other income group.

III. The majority of the sixty-seven recreational activities maintained their rank according to frequency of participation from one age grouping to the succeeding grouping. Apparently, the recreational habits of younger men do not differ greatly in kind from those of older men.

A. With increasing age, men participated less frequently in the following activities:

1. Conversing
2. Social drinking
3. Night-clubbing
4. Dating
4. Dating
5. Weight-lifting
6. Calisthenics

B. Participation in recreational activities of a sports type is meager at all age levels.

1. Bowling, still-fishing, and bait-casting were the only sports listed among the first twenty activities for all four age groups with respect to frequency of participation.

C. As men grow older, they participate less frequently in almost all forms of recreational activity.

D. The proportion of their leisure time which men spend on gardening, motoring, hiking, metalcraft, bait-casting, still-fishing, and checkers increases slightly with age.

IV. Men of all income groups participate very little in sports during their leisure time.

A. Men of the $5,000-$7,000 income group participate in sports more frequently than men of any other income group.

B. Men of the $2,000-$3,000 income group participate in sports less frequently than men of any other income group.

C. Participation in sports increases in frequency from the $2,000-$3,000 income group up to the $5,000-$7,000 income group. However, men earning over $7,000 income participate in sports somewhat less than men of the $5,000-$7,000 income group. This is accounted for in part by the fact that men in the former group are older.

V. Men of the $5,000-$7,000 income group particpate in all forms of recreational activity with the greatest degree of frequency. Next in order of frequency of participation are those earning $4,000-$5,000; $3,000-$4,000; $0-$2,000; $2,000-$3,000; and over $7,000.

VI. Men of all age and income groups satisfy their desire to participate in recreational activities on an active or sports nature less frequently than they do those of a mildly active or sedentary nature.

A. Baseball, swimming, hunting, and movies showed a great discrepancy between the proportion of men liking the activity and the frequency of participation.

B. Track and field events, boxing, wrestling, photography, and puttering and repairing ranked among the first twenty recreations in discrepancy score for the 50-59 age group, but for no other group.

C. The discrepancy score decreases more rapidly for the active forms of recreation than it does for the sedentary forms.

1. As men grow older, they limit their recreational desires more and more, and are increasingly successful in satisfying them.

2. Men's fondness for the highly active forms of recreation generally decreases more rapidly than their fondness for the mildly active or sedentary forms.

D. The discrepancy score represents the difference between the percentage of men indicating liking for an activity and the average frequency of participation as indicated by the participation index.

VII. For income groupings, as for age groupings, the discrepancy between the interest in an activity and the frequency of participation in it was greater for the active forms of recreation than it was for the sedentary forms.

VIII. The reason for unsatisfactory participation most frequently listed by men of all age groups was lack of time.

A. The proportion of men who state that poor health limits their participation increases with age.

B. The proportion of men who state that lack of money limits their participation increases up to the age of forty to forty-nine and then drops rather sharply.

C. The proportion of men who state that lack of facilities limits their participation decreases with age.

D. More men list reasons for unsatisfactory participation in the active forms of recreation than for unsatisfactory participation in the sedentary forms. 478 pages. $6.10. Mic 58-4195

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Abstract published by special arrangement with The Ohio State University.

CRITICAL INCIDENTS IN INTERCOLLEGIATE ATHLETICS AND DERIVED STANDARDS OF PROFESSIONAL ETHICS

(Publication No. 25,160)

Melvin Michael Crawford, Ed.D.
The University of Texas, 1957

Supervisor: Professor David K. Brace

The Problem. The primary purpose of the study was to collect and identify types of ethically critical conduct demonstrated in actual situations by personnel connected with intercollegiate athletics and to formulate acceptable ethical standards as suggested by the respondents submitting the incidents.

The Procedure. The critical incident technique was employed as the research design for conducting the investigation. Basically, this technique outlines procedures for the systematic collection, categorization, and analysis of behavioral descriptions of critical actions being studied.

Collection and Classification of Data. The data supplied by the critical incident report blank consisted of the following: (1) statements of unethical action witnessed in intercollegiate athletics; (2) suggested standards of ideal conduct for the reported unethical actions; and (3) information concerning the age and position of the person involved, sport, and position of respondent.

A total of 300 senior colleges and universities of all sizes and types, representing all states and 60 collegiate conferences were utilized in the study. In all 2,910 critical incident report blanks were personally addressed and mailed to individuals in the following positions: college presidents; faculty representatives on the athletic committee; directors of physical education; directors of athletics; athletic trainers; head coaches of football, basketball, baseball, track, swimming, tennis and golf; and game officials. A total of 815 usable replies or 28 per cent were returned. These 815 replies yielded a total of 1,104 incidents of ethically critical behavior. The classification of incidents with common critical elements resulted in the formulation of 112 groupings of behaviors. These behaviors were grouped under 9 major areas and 25 subareas.

Findings. 1. The nine major areas arranged in descending order according to frequency of incidents reported, were as follows: Area One, Incidents Relative to Officiating; Area Two, Incidents Relative to Opponent Relationships; Area Three, Incidents Relative to Player Relationships; Area Five, Incidents Relative to Professional Relationships; Area Six, Incidents Relative to Recruiting; Area Seven, Incidents Relative to Public Relations; Area Eight, Incidents Relative to Eligibility Rules; and Area Nine, Incidents Relative to Scouting.

2. A total of 443 or 40 per cent of the incidents were classified under Major Area One, Incidents Relative to Officiating.

3. Seventy-nine per cent of the incidents returned were classified under the first four major areas.

4. Coaches were reported as instigators in 92 per cent of the total incidents returned by respondents.

5. Eighty-two per cent of the ethically critical actions reported involved the sports of football and basketball.

6. There was significant statistical evidence that a difference existed between (1) the number of incidents in the major areas when frequencies were grouped according to three age levels, (2) the number of incidents in the major areas when frequencies were grouped according to professional position of personnel involved in incidents, (3) football coaches and basketball coaches as to the total number of incidents reported for all subareas, (4) the number of incidents in the major areas when frequencies were grouped according to the professional position of the respondents, and (5) major and minor sports as to the number of incidents in the nine major areas.

7. From the statements of suggested ideal ethical conduct supplied by respondents and from a study of the 96 types of unethical action there was derived a total of 134 ethical standards or statements of correct ethical action. Each statement of ethical standard was supported by illustrations of types of critical incidents to which the standard should apply. The statements of ethical standards constituted a major finding of the study.

386 pages. $4.95. Mic 58-4196

THE PREDICTION OF BASEBALL ABILITY THROUGH AN ANALYSIS OF SELECTED MEASURES OF STRUCTURE AND STRENGTH

(Publication No. 24,476)

Gaylor Eugene Hooks, Ed.D.
George Peabody College for Teachers, 1957

Major Professor: Solon Sudduth

The purpose of this study was to determine the relation of selected structural and strength measures to success in the baseball skills of hitting, running, throwing, fielding, and overall baseball ability and to ascertain whether there are combinations of these measures which may be used to predict success in each area. Nineteen items of structure and strength and five criteria items were selected and administered to each of fifty-six freshmen at Wake Forest College in the fall of 1956-57, using aircraft tensiometers, a dynamometer, and other commonly used testing equipment. The obtained data were analyzed statistically. The correlation technique was used to determine the relationship of each variable to the criteria, and multiple correlations were computed so that combinations of variables could be isolated. These combinations were used to

develop multiple regression equations for the prediction of each of the five criteria.

Summary of Findings and Conclusions

At the .05 level a significant correlation for measures of structure and strength with each criterion was .264. Multiple correlations were computed and then two item multiple regression equations were presented in raw score form for the prediction of each criterion. The significant measures and predictive equations are presented below.

Hitting

Significant correlations were weight, upper arm girth, chest circumference, hip circumference, thigh circumference, right and left hand grip, right and left wrist flexion, right and left elbow flexion, right and left shoulder flexion, thigh extension, calf extension, and ankle extension.

The following combination had a multiple correlation of .790:

X_1 = .577 (upper arm girth) + .434 (left shoulder flexion) - 15.244

Running

Significant correlations were right and left wrist flexion, right elbow flexion, left shoulder flexion, and calf extension.

The multiple correlation was .423 for this regression equation:

X_2 = .031 (height) + .022 (left wrist flexion) + 5.144

Throwing

Significant correlations were upper arm girth, chest circumference, left hand grip, right and left wrist flexion, right and left elbow flexion, right and left shoulder flexion, thigh extension, calf extension, and ankle extension.

The multiple correlation for this combination was .748:

X_3 = 1.080 (height) + .594 (left shoulder flexion) - 64.549

Fielding

Significant correlations were left hand grip, right and left wrist flexion, right and left elbow flexion, right and left shoulder flexion, thigh extension and calf extension.

The multiple correlation was .565 for this regression equation:

X_4 = .597 (height) + .241 (left shoulder flexion) - 8.681

Total Ability

Significant correlations were upper arm girth, chest circumference, left hand grip, right and left wrist flexion, right and left elbow flexion, right and left shoulder flexion, thigh extension, calf extension, and ankle extension.

The multiple correlation for this combination was .686:

X_5 = .504 (height) + .279 (left shoulder flexion - 15.149

These highly significant correlations indicate the existence of a close relationship between the measurements and the criteria, and the results may be used to analyze more accurately the relative contribution of each muscle group to a successful performance in one of the fundamental skills.

Tables were devised which included the raw scores and T-scores for each test so that it was possible, after computing the predicted score for each subject, to refer to the related table and determine his skill level in terms of T-scores. All of the equations, except the one involving running, should be useful in discovering specific deficiencies in the skills studied, and the equations for hitting, throwing, and total ability can be especially useful in selecting potential varsity material. The equation for the total ability criterion may be used, with reservations, to classify students in the phases of the program of physical education and athletics of which baseball or softball is a part. 195 pages. $2.55. Mic 58-4197

CONSTRUCTION AND APPLICATION OF AN INSTRUMENT TO MEASURE OUTCOMES OF THE PHYSICAL EDUCATION PROGRAM AS AN INTEGRAL PART OF EARLY ELEMENTARY EDUCATION

(Publication No. 24,193)

Mary C. Taggart, Ph.D.
New York University, 1957

The Problem

The purpose of this research was to construct and apply an instrument to measure outcomes of the physical education program as an integral part of early elementary education.

Sources of Material

The construction and application of such an instrument required the following data:

1. A list of desirable outcomes of the early elementary physical education program from a survey of literature.
2. The identification in literature of the components of these desired outcomes.
3. The collection of words and phrases describing good and poor development in children of early elementary age which are observable in play activities.
4. A representative group of elementary teachers to serve as judges.
5. A representative group of children of early elementary age for application of the instrument.

Treatment of Material

The desired outcomes and components thereof were identified in literature. The collection of words and phrases was also derived from literature.

The forced-choice rating scale was selected as the technique for the instrument. The collection of words and phrases represented the basis for construction. The rating of each item on the list by judges as each referred to a particular child or known quality determined the value of each item as to degree of preference and as to discriminative power to differentiate between good and poor development or adjustment.

From the list items with their experimentally determined indices, pairs of words or phrases were selected

such that they appear of equal value to the rater (preference value) but differ in their significance for development of the child (discriminative value). High preference pairs were matched with low preference pairs to form tetrads. The matching process produced an instrument consisting of 22 tetrads. A scoring key and instruction manual were prepared.

The completed instrument was applied to an experimental populace of 84 boys and girls in grades one through three.

In a step beyond the original purpose and intent of this study, a revision was made of the original test. The revision was included as a possible aid in future test construction.

Conclusions

The Instrument -- This adaptation of the forced-choice technique to a test with sections has proved partially successful. Some aspects of development such as mental and aesthetic development did not produce enough items to appear in the test. Other sections did not include all the component parts thereof. The sections on self and group adjustment appeared to be the most complete and closely integrated sections while the section on physical development contained the most intermingling with other components.

Reliability is indicated by a correlation of .99 and objectivity by correlations of .95 for all total scores, with slightly lower correlations for section scores. Validity is indicated by test application scores that compare favorably with the known qualities.

The Application -- The instrument proved most successful in disclosing a wide range of scores for both total scores and section scores, spread throughout the possible scoring range.

All three classes tested tended to be consistent in scores in separate aspects of development and adjustment. Scores reveal that potentialities for leadership and group cooperation are present at an early age. The test revealed little information as to what level of achievement might reasonably be expected at different age levels.

Inferences were drawn that there is need of:

A flexible and varied program.
Emphasis on each child's progress at his own level.
Opportunities for leadership and group work.
Help and guidance for several individuals in each class.

The instrument proved its ability to discriminate between various degrees of development and adjustment for each class tested, and to furnish a sound basis for guidance toward further growth. 190 pages. $2.50. Mic 58-4198

DEVELOPMENT OF PHYSICAL EDUCATION PROGRAMS IN STATE RESIDENTIAL SCHOOLS FOR THE DEAF

(Publication No. 24,492)

Linwood Jefferson Van Horn, Ed.D.
George Peabody College for Teachers, 1957

Major Professor: Solon B. Sudduth

The purpose of this study was to trace the development of physical education programs in the American state residential schools for the deaf from their origin to the present. Significant developments were described, and the general characteristics and influences in each stage of development were identified. Apparent variations from physical education programs in the American public schools were noted.

The study was limited to those schools listed as public residential schools for the deaf in the United States in the directory of the January, 1956, issue of the American Annuals of the Deaf.

Background and data for the study were acquired through visits to the Volta Bureau, Gallaudet College and fourteen of the state residential deaf schools. Primary sources were the American Annuals of the Deaf, The Volta Review, official school reports, convention proceedings, and school publications. Secondary sources included master theses, doctoral dissertations, histories of residential deaf schools, histories of physical education, and publications relating to education of the deaf in the United States.

The study was presented in narrative form, and the historical method of research was used. The main body of the study was divided chronologically into chapters representing periods in the development of physical education. Significant characteristics and influences were given topical treatment in each chapter. The final chapter included recommendations for general program improvement.

Findings of the Study

After the founding of the American Asylum for the Deaf and Dumb in Hartford, Connecticut, in 1817, the organization of schools for the deaf in other states followed. Early in the history of American residential deaf schools responsibility was accepted for the physical welfare of the pupils. The value of physical education was recognized, but efforts for organized programs were unmethodical. Military training, Jahn gymnastics, manual labor, physical education for women, and Dio Lewis' gymnastics contributed to the origin of systematized programs of physical education.

The recognition by authorities of the need for physical education and the building of the gymnasium at the national college for the deaf in Washington, D. C., in 1881 signalized the beginning of organized programs among state residential deaf schools.

Systems of physical education prevalent in America directly influenced the early programs. By 1900, organized programs, with trained personnel, definite objectives, and specific facilities, were emerging. A typical balance and gait among the deaf were considered special problems.

From 1900 to 1924, programs were expanded and

program content was enlarged. Gymnastics, military training and competitive athletics were the major forms of activity. The objective of increased strength was supplemented by emphasis on coordination and modification of behavior patterns.

After World War I, physical education received new impetus. Status was clarified by research and augmented by professional meetings among deaf school physical educators.

The natural movement was introduced, and athletic competition became the dominant feature of physical education programs with sectional and national tournaments developing. Rhythms assumed importance in the instructional programs. Intramural sports were highly developed. Health education became supplementary to physical education, and recreation developed as part of the extracurricular program.

Current opinions of authorities in residential deaf schools indicate trends toward a broader concept of physical education, a greater variety of activities offered in the program, multiple-use facilities, and a demand for professionally trained personnel.

Physical education programs in the residential deaf schools have developed parallel to those in the public schools with some necessary adaptations and adjustments.

272 pages. $3.50. Mic 58-4199

THE RELATIONSHIP BETWEEN LEISURE TIME ACTIVITIES AND PHYSICAL EDUCATION PROGRAMS FOR MICHIGAN HIGH SCHOOL GIRLS

(Publication No. 25,361)

Christine Lynn Vendien, Ed.D.
Stanford University, 1957

The Problem and Its Importance

Relative to the leisure time objective of physical education, this study seeks to determine what activities included in physical education programs most adequately meet the physical recreation interests and relate most closely to leisure time participation in physical recreation activities of Michigan high school girls. The following basic sub-problems were identified:

1. What activities included in physical education programs contribute to the leisure time objective of physical education?
2. What physical education activities are offered in selected class A, B, C, and D schools in representative geographic areas in Michigan?
3. What are the school-sponsored physical education activities in which students report participating during senior high school?
4. What are the nonschool-sponsored physical recreation activities in which students report participating during leisure time?
5. What are the physical recreation activities that students like?
6. What are the physical recreation activites for which students express an interest?
7. What are the reported reasons for not participating in activities in which they have expressed an interest?

As early as 1918, "Education for Leisure" was listed by the Educational Policies Commission as one of the Seven Cardinal Principles of Education. Because of the vast increase of leisure time today and our increased consciousnes of social and personal problems resulting from poor use of leisure time, educators need to look at the entire curriculum to determine what contribution each area is making toward this principle. Therefore, physical educators, aware of the disturbing trend toward passive spectator rather than active participant leisure time activities, need to examine current data regarding physical education programs in determining what contributions they are making toward the leisure objective.

Procedures Used in Collecting Data

By stratified random sampling technique, 86 schools were selected for the study. Data were collected by questionnaires from women physical education teachers and 10th, 11th, and 12th grade high school girls from class A, B, C, and D schools in representative geographic areas in Michigan. Validation of these questionnaires was established by selecting items most commonly mentioned after (1) consulting physical education, recreation, and research personnel, (2) studying national surveys of physical education and recreation programs, (3) examining courses of studies in physical education prepared in specific communities in Michigan and neighboring states, (4) consulting recreation reports from Michigan communities to determine which physical education activities were included in community recreation programs.

Results of the Study

In the total physical education program, 50% or more of Michigan high school girls reported participating in 8 different activities including 3 team sports, 2 gymnastic activities, 1 individual and dual sport, 1 rhythmic activity, and 1 recreational game. With 25% or more reporting, 20 different activities were listed. The major additions were individual and dual sports, rhythmic activities, recreational games, and aquatics. The class program was less broad. However, in the out-of-class program, the additional activities were outing, aquatics, recreational games, and gymnastics.

There were 11 different leisure time activities reported by 50% or more of the girls and 32 activities reported by 25% or more. Of these, 7 were outing, 7 recreational games, 5 individual and dual sports, 4 rhythmic activities, 3 aquatics, 3 team sports, and 3 gymnastic activities. This list was almost identical to those activities girls reported they have tried and liked.

Horseback riding, water skiing, swimming, skiing, golf, and tennis were the most popular new activities in which girls would like to participate if given an opportunity. Reasons for not participating were "no facilities," "no one to teach the skill," "lack of skill," "lack of time," and "no one with whom to do it."

The following table summarizes the comparisons of the physical education program with leisure time, liking an activity, an interest in an activity, and a desire to try a new activity:

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	Leisure		Like		Interest		Desire to try	
	r	p	r	p	r	p	r	p
Physical education program	.538	<.01	.642	<.01	-.178	>.05	-.082	>.05
In-class program	.280	<.05	.410	<.01	-.258	>.05	-.235	>.05
Out-of-class program	.928	<.01	.947	<.01	.105	>.05	.375	<.01

Using 25% or more of the girls reporting participation, various comparisons of specific activities were made and significance levels indicated. It was found that all of the activities offered in physical education programs were used during leisure time except soccer and cheerleading. However, there were many other outing activities, recreational games, aquatics, and individual and dual sports in which girls either participate during leisure time or express an interest in learning.

In comparing sizes of schools, larger schools offered broader programs, including more individual and dual sports, outing activities, rhythmic activities, and aquatics. Physical recreation interests appeared quite similar.

Broader physical education programs were found in geographic areas 1 and 2, however, the physical recreation interests seemed to be similar in all parts of the state.

Women physical education teachers reported slightly more activities than did students. New activities they would like to offer corresponded quite well with those that students have shown an interest in learning. "Facilities," "lack of time," "lack of teaching qualifications," and "class size" were reasons for not offering.

Implications

Because outing activities, recreational games, and swimming seemed to be the popular leisure time activities, more schools may want to look at the feasibility of including some of these in the physical education program.

Higher correlation was found between the out-of-class program with leisure time activities than with the class program. Therefore, teachers may want to investigate this and examine reasons why fewer girls participated in this program and determine possible ways to increase participation.

Physical educators, community recreational personnel, and community agencies may want to plan together more effectively so there can be better integration of the school physical education program and leisure time possibilities in the community. 252 pages. $3.25. Mic 58-4200

EDUCATION, PSYCHOLOGY

SELECTED FACTORS ASSOCIATED WITH THE VALIDITY OF TEACHERS' MARKS: A STUDY ON THE RELATIONSHIPS BETWEEN MARKING VALIDITY AND SELECTED VARIABLES SUBJECT TO TEACHER CONTROL FOR HIGH SCHOOL TEACHERS OF ACADEMIC SUBJECTS

(Publication No. 24,972)

Abraham H. Birnbaum, Ph.D.
New York University, 1957

The purpose of this study was to determine the relationship between each of the following variables and marking validity:

1. Subject-matter area
2. Marking severity
3. Marking variability
4. The relative importance to marking of each of a set of methods of observation, and
5. The relative importance to marking of each of a set of student characteristics.

The ultimate intent was to gain knowledge which can be used to improve the validity of teachers' marks.

The following data were obtained for each of 113 teachers of two New York City High Schools:

1. The subjects taught by the teacher
2. The marks he had given to each of his students of a specified graduating class
3. The mark averages for each of these same students, and
4. His responses on a list of (a) methods of observation, and (b) student characteristics, which he ranked in order of importance to marking.

For each teacher, the correlation coefficient was computed between the marks he had given his students and his students' mark averages. This correlation coefficient served as the teacher's score on marking validity. In addition, the arithmetic mean, the standard deviation and the mean deviant mark were computed for the marks given by each teacher. The mean deviant mark was obtained by subtracting the arithmetic mean of the mark average of the students from the arithmetic mean of the marks he had given his students. The sum of the arithmetic mean of the marks and the mean deviant mark, both in standard score form, was the teacher's score on marking severity, and the standard deviation of the marks was his score on marking variability.

Chi-square and t-tests were set up to test the relationship between marking validity and subject-matter area, marking severity, and marking variability. With respect to the relative importance to marking of (a) methods of observation and (b) student characteristics, rank order correlation coefficients were computed between the ranks provided by the relatively valid and non-valid markers for the two variables, separately. The results and conclusions are summarized below:

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

1. There was only one statistically significant relationship and that between marking validity and marking variability. Teachers who used more of the range of the marking scale gave more valid marks than teachers who restricted themselves to only a portion of the scale.

2. There was near unanimity among teachers as to the ranks on importance to marking of (a) the methods of observation, and (b) the student characteristics. This invariance in ranks might be the cause for the absence of relationships between marking validity and either of the two "variables." This conclusion is further supported by the relatively high, average marking validity. The median marking validity for teachers in school A was r = .73, and in school B it was r = .70.

3. The three most important methods of observation to marking from most to least were:

   a. Observation of classroom work
   b. Testing
   c. Check of homework assignment.

4. The three most important student characteristics were:

   a. Ability as reflected by quality of work

   b. Cooperation and participation in class and school projects

   c. Interest and perseverance as reflected by amount of work.

5. Although the relationship between marking validity and preference for objective vs. subjective tests was not significant, the results were in the direction which favored objective tests.

145 pages. $2.00. Mic 58-4201

FORCED CHOICE RATING SCALES FOR TEACHER DISCIPLINE

(Publication No. 24,106)

Eva Eunice Goodenough, Ph.D.
The Ohio State University, 1951

The dissertation is a study of the personality traits which are conducive to the control of elementary and junior high school children. The method used was the experimental construction of forced choice rating scales. The criterion used was teachers' anonymous ratings of their colleagues.

With the aid of descriptions of teachers considered effective and ineffective in discipline (written by students in the elementary educational psychology course at Ohio State University), a list of 298 descriptive words and phrases was made and printed in rating sheet form. Teachers attending summer school classes at Florida State University, State Teachers College (Jacksonville, Ala.), and State Teachers College (Florence, Ala.), and teachers attending Saturday and afternoon classes offered by State Teachers College (Troy, Ala.) and Georgia Teachers College, were asked to fill out two forms apiece, rating from the standpoint of discipline one teacher considered very effective and one considered very ineffective in classroom relations with pupils. Rating was done by encircling a number from 1 to 5 to indicate the extent to which each of the 298 descriptive items applied to the teacher being rated. Each rater was asked to indicate what grade level the person being rated taught and in which third of a representative group of 30 teachers of the same or similar grades he or she would rank as far as effectiveness of discipline was concerned. About 300 usable schedules were obtained in this manner.

Results were analyzed separately for ratings of primary, intermediate grade, and junior high school teachers. A discrimination index (indicating the extent to which the item differentiated effective from ineffective teachers) and a preference index (indicating the degree to which the item was judged to apply to the teachers rated) were computed for each item at each of the three grade levels and used as bases for selecting items for the forced choice rating scales. Items omitted by more than 10 per cent of the raters were not used.

Items for the forced choice forms were arranged in groups of four, or tetrads. The directions compelled the raters to choose in each tetrad the item most applicable, and the item least applicable, to the person being rated. Each tetrad contained one item with both a high preference index and a high discrimination index, one with both a low preference index and a low discrimination index, one with a high preference index combined with a low discrimination index, and one with a low preference index combined with a high discrimination index. The form for rating intermediate grade teachers contained 20 tetrads; those for rating primary and junior high school teachers each contained 25 tetrads. Spaces were provided for indicating the grade level taught by the person being rated and for giving an over-all rating on effectiveness of discipline by telling in which fifth of a representative group of teachers of the same or similar grades the person being rated should be placed.

Rating forms were presented to teachers in public schools in Escambia County, Florida, with the request that each teacher fill out three forms, rating one teacher considered very effecitve in discipline, one considered very ineffective, and one considered to be somewhere between the two extremes. The effective teacher was described as being not necessarily strict nor the one in whose classroom children are the quietest, but one in whose classroom children are coöperative and orderly in behavior. The ineffective teacher was described as one in whose classroom children are rude, disorderly, mischievous, and unnecessarily noisy.

Eight hundred fifty-eight usable forms were returned to the writer -- 390 rating primary teachers and 234 rating teachers at each of the other two grade levels.

Rating sheets were scored, giving credit of plus one for each discriminating complimentary choice and minus one for each discriminating derogatory choice. A system of prorating was used in scoring papers on which one or two choices had been omitted.

Correlations between the rating scale scores and criterion ratings were .814 (Pearson r) for primary teachers, .740 for intermediate grade teachers, and .758 for junior high school teachers.

Distributions of scores on the forced choice scales showed some resemblance to the corresponding distributions

of criterion ratings. All were negatively skewed, but the distributions of scores and of criterion ratings for primary teachers were more skewed than those for the intermediate and junior high school teachers. The highest validity coefficient (.814) was obtained for the forced choice scale scores corresponding to the ratings which showed the greatest departure from normality of distribution (the ratings of primary teachers).

Reliability coefficients, determined by the split-half method, were .971, .973, and .980, respectively.

An item-criterion analysis was done on each item in a random sample of 100 sheets rating primary teachers. Product-moment correlations ranged from .512 through .727. The median $\underline{r}$ was .655. The average item intercorrelation, as estimated by the Kurtz formula,[1] was .626. This high average intercorrelation suggests that the halo effect was operating to raise the validity coefficients.

Two types of item alternative analyses were done on random samples of 100 papers for each of the three grade levels. A simple index used by the Army for indicating the extent to which halo effect might contribute to the score was used for one kind of alternative analysis. This index consists of the proportion of the total number of complimentary choices that were choices of the discriminating item. Low indices (.50 to .599) were considered desirable, and items with indices of .90 or above were discarded, by the Army. None of the items in the rating scales used in this study was found to have an index higher than .859. About 28 per cent had low (good) indices, about 38 per cent had indices medium in size (.599-.699), and about 34 per cent had high indices (.699-.859). The scale for intermediate grade teachers was found to be superior to the other two scales by this method of alternative analysis.

In order to provide a rough index of the discrimination value of each alternative, the number of persons rated in the highest two-fifths in discipline for whom that alternative was selected as most characteristic minus the number in the lowest two-fifths for whom the same alternative was chosen was divided by the total number of selections of the alternative. The alternative in each tetrad with the highest positive index was scored plus one on a revised scoring key. The one with the highest negative index was scored minus one. Indices differing from each other by .1 or less were considered equal, so that two items were frequently given the same scoring weight. The keys for the items selected as least applicable to the persons being rated were revised by following a similar procedure. Most of the changes made in the keys consisted in giving equal credit for two alternatives. The key for the scale for rating intermediate teachers was the one most extensively changed.

Cross-validation on other random samples of 100 papers each showed slight increases (.014, .015, and .027) in validity when the revised keys were used. Giving equal weight to two alternatives eliminates the forced choice nature of the scale and allows more opportunity for halo effect to operate. For this reason and because the revised keys were more awkward to use than the original ones, the slight increases in apparent validity were not considered sufficient to justify using them.

The same samples that were used for the cross-validation of the revised keys were then scored for "Most Like" and for "Least Like" choices alone. Scoring for "Most Likes" alone raised the validity coefficients some, while scoring for "Least Likes" alone lowered them. Increases in validity when the "Most Like" items alone were scored were .019, .002, and .001. Such slight increases were not considered to justify lowering the reliability of the scales by scoring only half the items.

The use of a criterion consisting of single ratings made by the same persons who filled out the forced choice forms made it probable that bias and halo effect were operating to a significant degree. The high validity coefficients obtained are to be attributed in part to these extraneous factors and only in part to a real association between personality traits and effectiveness in discipline. It is impossible to isolate these factors in the present study.

Leniency is a major problem in most rating situations. In a forced choice situation this is shown by making only complimentary choices. The "forced" choice is the choice between two nearly equally complimentary or derogatory items. Practically all scores are positive, and the magnitude of the total score depends upon the consistency with which the discriminating items are selected in making the complimentary choices. In the present study, however, teachers were rating some whom they had selected as being ineffective in discipline. In such cases they did not seem to be loath to make derogatory choices. About 30 per cent of the total scores for the scales were negative. Non-discriminating derogatory choices neither add to nor subtract from the total score, but if one made all derogatory choices, half of them could be expected to be discriminating on a purely chance basis. In distributions like that obtained in this study, the forced choice breaks down, and it is possible to place an individual in the lower one-third or upper two-thirds of the distribution merely by making all derogatory or all complimentary choices. (It is, of course, perfectly obvious which choices are complimentary or derogatory, but it is not so obvious which ones discriminate.) This situation makes it easier for bias and halo effect to influence the position of the score of the individual in the distribution.

If the items had been arranged in nearly equally complimentary or derogatory pairs rather than in tetrads, the forced choice nature of the scales would have been retained, and this opportunity for bias would have been eliminated. At Dr. Wherry's suggestion, a random sample of 100 rating sheets for junior high school teachers was scored in such a manner as to show what scores would have been obtained had the paired arrangement been used. Each discriminating complimentary choice and each non-discriminating derogatory choice was scored plus one, and no minus credits were given.

Scores obtained in this manner correlated .647 with the criterion measures. It is suggested that this is probably a truer measure of the validity of the scale than the coefficient obtained when the original key was used (.756 for this particular sample of 100 papers).

The first part of the study suggests that certain traits are associated with effectiveness in discipline. The association exists in connection with the personalities of the teachers rated or the thinking of the teachers doing the rating or (probably) in both. Most desirable traits are associated with effectiveness in discipline, but some (e.g., kindness, patience, coöperation, sympathy, and tact) are more closely associated than others (such as self-confidence, frankness, independence, and modesty). Some traits seem to be more closely associated with effectiveness in discipline at some grade levels than at others. For instance, affectionateness is more closely associated

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at the primary level than in the intermediate grades, and gentleness is more closely associated at the elementary school than at the junior high school level.

Traits associated with ineffective discipline also differ with the grade level taught in some instances. Being disillusioned, for example, differentiates better at the junior high school level than in the primary grades, and "always making excuses" and being sarcastic differentiate better at the elementary school than at the junior high school level.

Since no tests of the statistical significance of these findings were made, they should be accepted as hypotheses for further research rather than as verified facts.

202 pages. $2.65. Mic 58-4202

1. Kurtz, A. K. "A Special Case of the Multiple Correlation Coefficient," J. Educ. Psychol., 20 (May, 1929), pp. 378-85.

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ACHIEVEMENT OF FAST LEARNERS IN A PARTIALLY SEGREGATED ELEMENTARY SCHOOL PROGRAM, WITH SPECIAL REFERENCE TO SCIENCE INSTRUCTION

(Publication No. 25,353)

Richard Henry Hinze, Ed.D.
Stanford University, 1957

Statement of the Problem

This study, using an elementary school population, was designed to determine the effect on selected achievement areas when part time special classes were provided for fast learners. The problem was studied by means of an experiment in which the following three questions (stated in general form) regarding certain achievement factors were considered:

a. Do fast learners who attend part time special classes make greater gains in achievement than fast learners who stay in regular classes?

b. Do children not identified as fast learners benefit in achievement when the fast learners are removed from the regular classroom on a part time basis?

c. Do fast learners, who indicate an interest in science and who are given extra opportunities to work in science, increase their science activities out of school?

This research was conducted with the limitations exacted by the Board of Trustees and the Superintendents of the Ravenswood City School District who requested assistance in evaluating the Fast Learner Program.

Procedure

The Ravenswood Fast Learner Program called for fast learners, children with the Stanford-Binet 120 IQ or higher, to be taken from regular to special classes twice a week for 90 minutes--total of three hours per week--where special experiences in art, biological science, physical science, and social studies were made available to them. There were special teachers, rooms, and equipment to help the children pursue activities and projects in these areas.

The criteria of achievement for this experiment were the complete elementary and intermediate batteries of the California Achievement Tests for questions a and b; and for question c, a free time activities questionnaire. These instruments were administered in January and May, 1956.

Four groups--184 experimental, 194 control fast learners; 651 experimental, and 579 control normals (terms given behavioral definitions for this experiment)-- were identified to answer questions a and b. Two further groups --82 experimental and 86 control fast learners interested in science--were identified to answer question c. Comparisons of changes between groups in questions a and b were made using mean gain differences and tested with the critical ratio technique.

Findings

With reference to questions a and b and limiting achievement factors to those measured by the California Achievement Test, the general findings were that no significant differences could be found between any of the fast learners or normal groups. No findings of statistical or educational significance obtained for question c because of the inadequacy of the data.

Conclusions

Within the limits of the Ravenswood Fast Learner Program, and subject to certain possible qualifications:

a. Fast learners, when removed from their regular classes for three hours a week to attend special classes in certain subjects, showed no significant differences in their achievement as measured by the California Achievement Test.

b. Normal subjects, when fast learners were removed from their regular classes for three hours a week-leaving normal subjects in a form of ability grouping, showed no significant differences in their achievement as measured by the California Achievement Test.

c. No general conclusion was drawn with respect to changes in behavior in science activities out of school.

Since the experiment did not include measurement of gains or losses in the areas of the special classes, and since no noticeable effects were found with respect to the curricular areas tested, the Ravenswood City School District was encouraged to continue the program and to carry on further research. 134 pages. $2.00. Mic 58-4203

THE RELATIONSHIP BETWEEN EMOTIONAL ADJUSTMENT, THE AMOUNT OF NEED SATISFACTION ACHIEVED AND THE ABILITY TO DIFFERENTIATE WAYS OF OBTAINING NEED SATISFACTION

(Publication No. 25,241)

William Andrew Lewis, Ed.D.
University of Illinois, 1957

The purpose of the study was to examine the relationships between emotional adjustment, amount of need satisfaction obtained, and ability to differentiate ways of obtaining need satisfaction. The specific hypotheses that were tested were the following: (1) the measured amount of need satisfaction obtained by a maladjusted person is less than that obtained by an adjusted person; (2) there is a positive relationship between the measured amount of need satisfaction experienced and the similarity between stated and measured ways of obtaining need satisfaction; (3) the stated and measured ways of obtaining need satisfaction are more similar for adjusted persons than for maladjusted persons. The similarity between a person's stated and measured ways of obtaining need satisfaction is considered to be a measure of his ability to differentiate how he achieves need satisfaction.

Sample

The subjects were two groups of male hospitalized veterans. One group was considered to be emotionally maladjusted and was made up of twenty-five subjects who had functional psychiatric diagnoses and on the basis of the MMPI were considered to be the most maladjusted of those tested. The second group was made up of twenty-five subjects who had medical-surgical diagnoses and on the basis of the MMPI were considered to be the best adjusted of those tested.

Procedure

The Interpretation section of the Reading Comprehension part of the California Achievement Test battery, Elementary Form, was administered to determine which subjects had sufficient reading ability to read effectively the other instruments. The Edwards Personal Preference Schedule (PPS) was used to find the measured ways of obtaining need satisfaction. The stated ways of obtaining need satisfaction were determined by having each subject rank the definitions of the needs categories around which the PPS was organized. Three estimates were made of the amount of need satisfaction each subject achieved. Two of them were based on the subject's responses to a series of sixty described activities, and the third was one over-all estimate made by the subject.

Major Limitations

One of the major limitations of this study is the fallibility of the measuring instruments. The instruments do not unerringly reflect a person's feelings or behavior. A second limitation is that one cannot be certain that the similarity between a person's stated and measured ways of obtaining need satisfaction is the best indication of his ability to differentiate his ways of obtaining need satisfaction. Another limitation is the lack of absolute discreteness between the two groups with respect to their emotional adjustment.

Results

The first hypothesis was confirmed beyond the one per cent level of confidence. The second and third hypotheses were not confirmed.

These findings showed conclusively that the adjusted group gained more need satisfaction than the maladjusted group, but that the similarity between measured and stated ways of gaining need satisfaction was not related either to emotional adjustment or to the amount of need satisfaction experienced. This lack of relationship indicates that adjusted and maladjusted persons are equally consistent in discribing the ways they have of gaining need satisfaction. The results suggest that maladjusted persons are not necessarily suffering from an intellectual disorganization of their self concept, but that the feelings of maladjusted persons are significantly different from those of adjusted persons. 68 pages. $2.00. Mic 58-4204

RELATIONSHIPS AMONG INTELLIGENCE QUOTIENTS, ENVIRONMENTAL VARIABLES AND READING ACHIEVEMENT OF FOURTH-GRADE PUPILS

(Publication No. 25,168)

Jacob Mandel, Ph.D.
The University of Texas, 1957

Supervisor: Professor Emery P. Bliesmer, Ph.D.

Five questions were raised concerning the relative influence of each of the following five variables upon reading comprehension and reading vocabulary of fourth grade pupils.

1. A child's IQ.
2. Parents' value system.
3. Amount of reading materials in the home.
4. Parental educational aspirations for the child.
5. Best friend's reading behavior and attitudes.

The questions were as follows:

1. Is each of the five non-reading variables correlated with reading comprehension and with reading vocabulary?
2. Are there sex differences with respect to any of the variables?
3. Do the variables correlate differently with reading comprehension than with reading vocabulary?
4. How much of the reading comprehension and reading vocabulary variance is accounted for by each of the five variables?
5. Can these five variables be reduced to a smaller number of factors?

The sample consisted of 106 fourth grade boys and girls almost equally divided as to sex, in three schools in a large Texas city. All children were from "Caucasian" English-speaking families. These sample restrictions precluded development of complications due to differences stemming from varied ethnic and color caste backgrounds.

Reading comprehension and reading vocabulary were measured by the Iowa Every-Pupil Tests of Basic Skill, Test A: Silent Reading Comprehension, Elementary Battery (New Edition).

A Parents' Questionnaire designed for the study was used to obtain measures of three variables. Parents'

value system was measured by a section consisting of the Index of Value Orientation developed by McGuire. A second section consisting of questions relative to number of books, magazines, and newspapers in the home was used in determining an index of amount of reading material in the home. An index of parental educational aspiration was based on responses to a question eliciting the amount of formal education aspired for a child.

No significant sex difference was found for any variable. Beta weights computed indicated that 35 per cent of reading comprehension variance was accounted for by verbal IQ. Thirty-five per cent of reading vocabulary variance was accounted for by verbal IQ and only 4 per cent by parents' IVO. The other three variables account for none of the variance of reading comprehension or vocabulary. Thurstone's Centroid Method was used in factor analyzing the data for all seven variables. Two factors were extracted. Factor A was interpreted as an intellectually-weighted value orientation factor. Factor B was interpreted as a general reading factor involving intellectual ability, information and comprehension of printed matter.

On the basis of the results it was concluded that, of the five variables measured, only IQ plays an important role in reading achievement among fourth grade "Anglo" children. Parents' value system, educational aspirations for the child, amount of reading materials in the home and best friend's reading behavior and attitudes do not appreciably influence children's reading achievement. There were indications that this may have been brought about by the neutralizing of negative home influences by the school in many cases. Further research at both lower and higher grade levels is needed to help fill out the developmental picture in this area and to give an indication of how much effect values taught in the school have upon reading achievement. 104 pages. $2.00. Mic 58-4205

A FORCED-CHOICE APPROACH TO THE MEASUREMENT OF TEACHER ATTITUDES

(Publication No. 25,250)

Dominick Mazzitelli, Jr., Ph.D.
University of Illinois, 1957

Purpose

The major purposes of this investigation were (a) to develop a forced-choice teacher attitude inventory measuring essentially the same attitudes as are measured by the Minnesota Teacher Attitude Inventory (MTAI), (b) to evaluate this forced-choice inventory, called the Teacher Opinion Preference Inventory (TOPI) in terms of its reliability and validity, the criterion of validity being pupils' ratings of teachers, (c) to study the change in validity of the unforced- and forced-choice inventories as length was increased.

Other aspects of this study were (a) a replication of N. L. Gage's study comparing "logical" dichotomous and and trichotomous keys with the published empirical key of the MTAI as to their reliability and validity, (b) the determination of the reliability and validity of "intensity" response sets elicited by a six-point response scale in the TOPI, (c) the determination of the reliability and validity of scores obtained by weighting responses on this six-point scale.

Method

In developing the TOPI it was possible to maintain the same item content and item sequence as in the MTAI. In scoring the TOPI the item in each pair that had the higher discriminative index was scored plus one if it was an item in which agreement was scored plus one. It was scored zero if it was an item in which disagreement was scored plus one on the MTAI. The pairing of items from the published form of the MTAI with items which were rejected in the development of the MTAI was carried out on the basis of an acceptability and discriminative index for each item; these indices were based on data obtained from Leeds. That is, in constructing the TOPI it was possible to use (through the generous cooperation of Carroll H. Leeds) 735 items, and the distribution of responses thereto by "superior" and "inferior" teachers, which Leeds had obtained in his original work on the construction of the MTAI. From these data were developed our indices for each item that were used to pair items in the TOPI. All instruments were given by trained administrators to 147 fifth- and sixth-grade teachers and their 3048 pupils in four communities in central Illinois. Data for 126 teachers were usable.

Results

Our estimates of reliability for the inventories scored at full length with the various keys ranged from .836 to .955.

The correlations of the MTAI scored with the published key and of the TOPI with My Teacher, our criterion, were .183 and .184 respectively; both rs were significant at the .05 level. The validity coefficients indicate that the TOPI is as valid as the MTAI and the correlation between the TOPI and MTAI indicates that the inventories measure essentially the same attitudes.

Contrary to the expectations that test validity would increase as length increased a drop occurred. An investigation of the validity of the TOPI pairs using pupils' mean ratings of teachers as the criterion indicated that only 81 pairs had differences between the means in the expected direction, i.e., similar to the scoring key weights developed on the basis of principals' judgments. The remaining 50 pairs reversed. These 50 reversals were the cause of the drop in validity as length increased.

Other findings in this study were that (a) the validities of the "logical" trichotomous and dichotomous keys were as high as that of the published empirical key, (b) the response set keys were reliable but did not correlate significantly with the criterion, (c) weighting responses according to "intensity" increased the reliability of the TOPI but decreased its validity.

148 pages. $2.00. Mic 58-4206

QUALITATIVE AND QUANTITATIVE DIFFERENCES IN THE LANGUAGE ABILITIES OF YOUNG CEREBRAL PALSIED CHILDREN

(Publication No. 25,251)

James Jerome McCarthy, Ph.D.
University of Illinois, 1957

A test of language ability, based on a comprehensive language theory, was administered to sixty-one spastic and twenty-three athetoid children. The following criteria were employed for the selection of subjects: (1) MA between 2-0 and 6-4, (2) CA between 2-0 and 8-7, (3) IQ of seventy or over, and (4) no serious expressive or sensory impairments. The intent of these criteria was to obtain subjects who were essentially normal except for motor handicaps.

The language test, composed of ten subtests, yielded a language age (LA) for each subtest, and overall LA, and a language quotient (LQ). In the comparison of spastic and athetoid groups, the spastics were significantly higher in overall LA when the groups were statistically equated on MA and CA. On subtest scores, spastics were significantly higher than athetoids on expressive language tasks requiring fine motor coordination, and on half of the tests of inner language.

Normal children were matched, child for child, with the cerebral palsied children by sex and on mental age. Comparison of spastic with normal children indicated the latter were superior on half the subtests, and on overall LA. Subtests on which differences occurred assessed expressive and receptive language.

Zero correlation was found between the language quotients (LQ - LA/CA) of cerebral palsied children and their socio-economic level and between the presence of siblings and IQ. Positive correlations were found between the LA of the cerebral palsied and the following: social age, mental age, and speech intelligibility. Zero correlation was found between the LA and the degree of impairment for these children.

Although no intra-group, boy-girl differences in LQ were found, a significant difference was obtained when all the boys were compared with all the girls; the difference favored the girls. Among the spastics, left hemiplegics tended to have higher LQ's than right hemiplegics.

Using a theoretical model of language function designed by Charles E. Osgood, Professor of Psychology at the University of Illinois, it was possible to break down the subtest scores into standard score, psycholinguistic units. These units were synthesized into scores for the three major levels and three processes of language, as described by Osgood, and these scores were plotted as six point profiles. Seventeen of the twenty-three athetoids had "W" shaped profiles; twenty-seven of the sixty-one spastics had "M" shaped profiles. When the individual profiles for each group were averaged, clear "W" and "M" shaped profiles were obtained for athetoids and spastics, respectively. The chief characteristics of these profiles was that spastic children tended to be high in grammatical or sequential functions but low in semantic or meaning functions while the opposite was true of the athetoids.

It was concluded that this test had potentiality for differentiating between spastics and athetoids and between normal and cerebral palsied children on the basis of language behavior.

These results suggest the need for a revision of the instrument employed. A refined test should show even clearer inter-group differences. The revised test can serve as (1) a basic research tool for the study of young children with language disorders, and (2) as a clinical instrument for the differential diagnosis of language disorders in an educational setting.

139 pages. $2.00. Mic 58-4207

CHARACTERISTICS OF HONOR GRADUATES OF THE UNIVERSITY OF NEBRASKA

(Publication No. 23,660)

Gourie Mukherjee, Ph.D.
The University of Nebraska, 1957

Adviser: Charles O. Neidt

The purpose of this study was twofold: 1) to identify characteristics which can be used as indicators of "honor graduate" status for students enrolled at the University of Nebraska; and 2) to determine the relationship between age of graduation from high school of honor graduates of the University of Nebraska and such attributes as occupational history, parental socio-economic status, and size of high school graduating class.

Honor graduates were defined as those students 1) whose cumulative grade point average at graduation places them in the upper three percent of their graduating class, and 2) who are graduated with distinction or high distinction.

The honor graduates included in the study were from the university graduating classes of 1939, 1940, 1941, 1944, 1945, 1946, 1949, 1950, and 1951. A random sample of 445 graduates chosen from the same classes was studied with respect to age of graduation from high school.

Data for the study were obtained from the Office of Registration and Records and from personal data questionnaires returned by 313 of the honor graduates. Analysis of the data yielded the following results regarding honor graduates.

1. As a group, they were significantly younger at the time of high school graduation than the random sample of their classmates.
2. More than ninety percent of them ranked in the highest quarter of their high school graduating class.
3. The mean American Council on Education Psychological Examination Linguistic scores was highest for those in the College of Arts and Sciences but the mean for those in every college was higher than that for the general student population.
4. The majority of them had enrolled for advanced education and were engaged in professional occupations.
5. Those who had graduates from high school at ages seventeen and eighteen reported no greater difficulty in securing employment or in mean job changes than those in the nineteen-year age group.
6. Those in the younger age groups tended to marry earlier, but have smaller families than those in the older age groups, although the percentage of honor graduates who were married in the older age group was smaller. Eighty-eight percent of the group had children.

7. They tended to select marriage partners who had completed at least a high school education, although the male honor graduates tended to select marriage partners with higher education than the female.

8. No definite relationships with age were found with respect to expenses earned in college.

9. The younger age groups tend to participate more often in activities than the older groups, and achieve more honors, individual as well as in a group, than the older age groups while at college.

10. Two-thirds of the fathers had received a high school education, although this percentage was larger for the mothers.

11. The occupation of their fathers listed most frequently was farming, followed closely by professional occupations.

12. Almost two-thirds of them had graduated from high school classes having less than one hundred members.

The tendency for the seventeen and eighteen year age groups to show an advantage in all areas of their personal history and occupational history over the nineteen year age group, except in activities and honors after graduation and in the number of children, supports the practice of acceleration. It may be inferred than the nineteen year group might have benefited by graduating earlier from high school. 140 pages. $2.00. Mic 58-4208

THEORIES OF ADOLESCENCE: AN ANALYSIS OF SELECTED AMERICAN AND EUROPEAN POSITIONS

(Publication No. 25,258)

Rolf Eduard Helmut Muuss, Ph.D.
University of Illinois, 1957

This thesis endeavors to bring together, to give an exposition of, to analyze, and to compare the major theoretical positions of adolescent development that have been advanced in the United States and Central Europe.

The problem is introduced in its historical-philosophical setting by an overview of the earlier philosophical ideas concerning the nature of human development, as advanced by Plato, Aristotle, Locke, Rousseau and G. Stanley Hall.

Some of the prevalent contemporary psychological positions that have made contributions to a theoretical foundation of a psychology of adolescence are also reviewed. Included are positions advanced by Buehler, Busemann, Davis, Dennis, Havighurst, Hollingworth, Kroh, Zeller and others.

The main analysis deals with three American and three Central European positions; included are Freud's psychoanalysis, Lewin's field theory, Gesell's theory of genetically determined maturation, Mead's cultural anthropology, Spranger's geisteswissenschaftliche Psychologie, and Remplein's theory of personality stratification. These theories were selected in the light of specific criteria. The methods used in the analysis are logical and deductive.

As the basis for comparison, important controversial issues concerning adolescent development are used that separate the proponents of developmental theories into opposing camps. The important issues are the predominance of biological or environmental factors in the developmental process, the relationship between physiological and behavioral changes during adolescence, the question whether development is continuous or takes place by stages, the basic differences between generalizations and the individual case, and methodological differences. Educational implications that logically can be derived from the theoretical constructs are discussed.

The information obtained from this analysis allows for conclusions and generalizations on three levels:

1. A comparison of theories in the light of the controversial issues.

Biologically oriented theories are those of Hall, Freud, Gesell, and Dennis. Psychosocially oriented theories are Benedict's, Davis's, Havighurst's, and Mead's. Field theory takes a compromising position.

Stages and phases are greatly emphasized by Remplein, Kroh, Gesell, Freud, Hall, and Zeller. They are implied by Benedict, Havighurst, Lewin, Mead, and Spranger, and denied by Hollingworth, Thorpe, and Cruze.

Personality manifests itself in the internal psychic structure for Remplein, Lersch, Spranger, and Freud, while its manifestations relate to external behavior for Gesell, Mead, and Benedict.

Categorization of methodological differences shows some overlapping. Based on empirical data are Gesell's, Mead's, and with limitations Freud's theory. Lewinian field theory is logically derived but is stimulating to empirical research. Spranger's theory is speculative, and with modifications this also holds true for Freud's and Remplein's.

2. A comparison of American and European positions.

Differences between American and European positions can only be considered as tendencies which have some exceptions. European theories are more closely related to philosophical systems and methodology, and consequently are more intuitive and speculative in their methods than American theories. They are more biologically oriented and emphasize stages and phases as a developmental law and, generally speaking, accept the biogenetic law.

American theories are more closely related to the physical sciences and consequently emphasize empirical methodology to a much greater extent than the European positions. Due to the greater influence of empiricism, social environmental factors are emphasized more in America, and development is frequently considered as gradual and continuous.

3. Generalization concerning the phenomena of adolescence that are supported by the majority of the theories discussed.

The earlier half of the second decade of life is universally marked by endocrinological changes and the maturation and growth of primary and secondary sex characteristics.

Body changes require readjustment and reorientation which are frequently reinforced by changes in social status and social expectations. These behavioral changes during the adolescent period relate to sex interest, sex awareness, resolving sexual tensions, body image, acceptance of socially expected role of masculinity and femininity, increased time perspective, preparation for marriage and vocation, and the establishment of economic and emotional independence.

While the specific forms of readjustment are greatly influenced by the pattern of society and social expectation and show great cultural differences, the general nature of

an adolescent need for readjustment and reorientation cannot be denied. Consequently there is theoretical support for the claim that pubescence and adolescence are related phenomena. 323 pages. $4.15. Mic 58-4209

PERCEPTION OF PICTURED SOCIAL INTERACTION BY BRAIN-INJURED AND NON-BRAIN-INJURED CHILDREN OF NORMAL INTELLIGENCE

(Publication No. 25,262)

Ellen Maxine Nudd, Ph.D.
University of Illinois, 1957

Perception has long been the subject of investigation. Its intriguing aspect has been recognition that, while sensations are important in perceiving, there is also an integrating process which uniquely structures every individual's perceptions. This subjective patterning applies not only to percepts of physical objects, but also to those of the self and interpersonal relationships. To help in determining what influences may affect the structuring process, this study has investigated the relationship of brain injury to perception of social interaction.

The problem of the study was: Are there any differences in verbalizations of perceptions of social interaction, as presumably depicted in a number of pictures, between a group of brain-injured children of normal intelligence, nine to thirteen years old chronologically, and a group of non-brain-injured children of comparable intelligence and chronological age? It was asked whether aberrations of perception (inability to differentiate figure and ground; persistent fixation on irrelevant details; perseveration; and, bizarreness of response) attributed to brain-injured persons by some other investigators would be evidenced.

Subjects for the study included 21 cerebral palsied children, 21 urban and 21 rural comparison children, attending public schools.

A set of magazine pictures showing persons interacting against a background of details was presented individually to each child. Responses were analyzed by three independent raters to determine the level of social interaction each child perceived in a picture. Three levels considered identifiable were: (1) Mere enumeration of items; (2) One-sided reaction; (3) Mutual social interaction. Median ratings of responses were compared statistically. The responses of the rural children consistently evidenced the highest level of social interaction, those of the brain-injured next highest, with those of the urban comparison group lowest. The responses of the rural group were judged as having the fewest bizarre elements, the brain-injured next, and the urban comparison the most.

Items, selected and adapted from Rogers' Test of Personality Adjustment, were presented to each subject. When these findings were considered in relation to other data in the study, it was noted that, in comparison to the other subjects, the responses of the urban comparison children suggested that they had a low opinion of themselves and more urgent needs to strive for social approval. It is possible that these strong emotional needs structured their perception of social interaction, causing them to look at the pictures from the frame of reference of desire for adult approval, with accompanying hostility at adult domination. If this were the case, it might not have been possible for these children to perceive adults and children as interacting on the same social plane. It is interesting to note that the rural group, who seemed to be the most secure in their own social relationships of all of the children in the study, were consistently the highest in the number who perceived the highest level of social interaction in the pictures.

From the findings of this study, it might seem that the factor of emotional needs was more potent in influencing perception of social interaction in the media used, than was the factor of brain damage.

141 pages. $2.00. Mic 58-4210

THE EFFECT OF SELF-OBSERVATION ON SELF-AWARENESS: AN EXPLORATORY STUDY

(Publication No. 25,334)

Bernard Peck, Ed.D.
University of Maryland, 1957

Supervisor: Professor Madelaine Mershon

Purpose:

The purpose of the study was to determine whether an individual, with limited expert assistance, could, through the instrumentality of a novel technique--the systematic observation and written recording and analysis of his behavior in accordance with specified psychological principles and procedures--increase his awareness and understanding of his behavior and affect favorably the quality of his personal adjustment. The procedures utilized were derived from principles and techniques for the understanding and growth of the self advanced by the psychiatrist Sullivan and the educator Prescott. These procedures were written up in the form of a manual and given to the participating individuals.

Procedures:

Six people, not representative of any characterizable population, volunteered, and maintained records of their actual behavior for an average of approximately sixty hours over a six-month period. However, the project extended over a period as long as a year or more in most cases--the additional time was required for an evaluation of the project and for the completion of the required testing.

The clients periodically turned over their records to the writer for review. They were returned with written comments, usually of a non-interpretive nature, designed to help them implement the procedures more adequately. After terminating the recording of behavior, the clients evaluated the project in terms of its effect upon themselves and their relations with people. They were then provided with a final interpretive statement developed by the writer which reported on the significance of the record as he saw it. The clients then responded to this statement. Finally, interviews were held with each client.

The following hypotheses were tested to determine whether constructive personality change had occurred:

I. The use of the self-observational procedures will result in greater awareness of one's patterns of behavior, and the feelings and needs which are part of this behavior.

II. (External) Behavior change will occur.

III. People in general will be more accepted and respected.

IV. Psychological tension will be reduced.

Each client was administered Butler and Haigh's S10 Q-Sort before the initiation of record-keeping, and after the response to the interpretive statement. Changes in the conception of self and the ordinary person were examined, and the differences in the pre and post self-ideal, self-ordinary and ordinary-ideal correlations were analyzed, in relation to the hypotheses being investigated. Also, the records of two cases considered successful were presented in detail and analyzed, having special reference to the support given to the hypotheses. One relatively unsuccessful case was also described in some detail. In the other three instances, sufficient material was provided to give some notion of the flavor of the client's communication and to justify the conclusion reached regarding the progress made.

Findings:

The analysis of the records and the test results, plus the information gathered in the terminal interviews, indicated that the hypotheses generally were upheld in two cases. In the four remaining cases, the hypotheses generally were not upheld, but in three cases forward movement of a minor sort was detected. It was concluded that the self-observational procedures had demonstrated sufficient utility to merit further investigation with a view to determining whether the expert assistance provided might be diminished or eliminated, and in terms of their effectiveness as a time-saving adjunct to conventional psychotherapy. 375 pages. $4.80. Mic 58-4211

STUDENT LIKING FOR TEXTBOOKS IN RELATION TO THEIR READABILITY

(Publication No. 24,188)

Murray Rockowitz, Ph.D.
New York University, 1957

PROBLEM

The investigation set out to discover the relationship between the readability of selected textbooks used in New York City senior high schools and the expressed liking for the textbooks by a sampling of students at different levels of reading ability who were studying them.

PROCEDURE

A sampling was made of six hundred students attending eight New York City academic high schools chosen to insure geographical distribution and with populations differing in achievement on the Nelson-Denny Silent Reading Test given as part of the New York City High School Division English Survey in 1947. To determine groups of students advanced, normal, and retarded in reading, the Nelson-Denny Silent Reading Test (Form B) was given to these students. This was followed by a questionnaire on student reading interests which included questions to determine the liking rating of a group of textbooks with provision for free response as to the reasons why the rating was given. Mean liking scores were determined for each of the textbooks for each of the reading groups. The Flesch readability formula (Part A revised) was applied to the textbooks to determine their relative readability. The differences among the mean liking scores for the groups of varying ability in reading were treated to determine their statistical significance.

CONCLUSIONS

1. The least readable (according to the Flesch formula) of the four world history textbooks used in the investigation, Thomas-Hamm's Modern Europe (1949 edition), is the one most widely used; the most readable, Roehm-Buske-Webster-Wesley's The Record of Mankind, is the least widely used.

2. The readability of the two most widely-used textbooks in the tenth year of high school (Thomas-Hamm and Schapiro-Morris' Civilization in Europe) is on the college level while that of the others rated (Roehm-Buske-Webster-Wesley and Lane-Goldman-Hunt's The World's History) is on the high school level.

3. As indicated by the "t" scores, significance of the difference between the mean liking scores of the Thomas-Hamm textbook and the Roehm-Buske-Webster-Wesley textbook and between those of Thomas-Hamm and Schapiro-Morris for the group retarded in reading is beyond the .005 or .5% level and is "very significant." That of Thomas-Hamm and Lane-Goldman-Hunt for the same group is at the 5% level and is "significant."

4. As indicated by the "t" scores, significance of the difference between mean liking scores of the Thomas-Hamm and Roehm-Buske-Webster-Wesley textbooks for the groups advanced and normal in reading is above the 5% level and is "insignificant," although that for the advanced group barely fails to meet the 5% level of confidence.

5. There is a substantial relationship (r = .645) between the twp liking scores given the textbooks by one-sixth of the students sampled when the second rating followed the first after a lengthy time interval.

6. Analysis of factors influencing student liking for textbooks reveals these patterns:

Pupils advanced in reading are more concerned with favorable factors of format than other groups.

Pupils advanced in reading are more concerned with unfavorable factors of content than other groups whereas pupils retarded in reading are more concerned with unfavorable factors in style.

Advanced and normal reading groups are more concerned with unfavorable factors of organization than the group retarded in reading.

RECOMMENDATIONS

1. A readability formula such as that of Flesch (Part A revised) should be applied to textbooks to provide an estimate of relative difficulty and an indication of the liking of students retarded in reading for textbooks of varying readability.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

2. Those who write and select textbooks for our secondary school pupils should be guided by the factors shown to influence student liking for these textbooks.

118 pages. $2.00. Mic 58-4212

THE EFFECTS OF RESIDUAL, BACKGROUND, AND STIMULUS ON CONTRIBUTING BEHAVIOR

(Publication No. 25,176)

Aubrey Henry Roden, Ph.D.
The University of Texas, 1957

Supervisor: Professor Carson McGuire

Problem: Employing Helson's adaptation-level paradigm to translate theory into experimental operations, what are the effects on contributing behavior of college students representing varying degrees of authoritarianism, anxiety, ascendance-submission, and tolerance when they are asked to increase the amounts of their contributions by inducers at two levels of status or prestige?

Subjects: 120 students in introductory educational psychology at The University of Texas; 15 males and 15 females drawn from two classes for each of four experimental conditions.

Procedure: In each class, a man appealed for help with the Easter Seal drive. Subjects marked blocks of time on contribution slips. Thirty minutes later a man requested more contributions, the first being insufficient. One inducer was a male peer (P), the other an authority figure (A) in the person of their college dean. Sequences were AA, PP, AP, PA (backgrounds) and both inducers used the same spoken appeal (stimulus). Class members earlier responded to the A-S Reaction Study, F scale, Sarason Test Anxiety, and a modified form of the California Psychological Inventory.

Results: An authority figure was more effective than a peer in soliciting contributions with a spoken appeal. Blocks of time increased significantly for the second induction and, over and above individual differences, increments were a function of degree of authoritarianism represented in subjects and experimental conditions. Subjects high in authoritarianism maximized contributions when dean followed peer; low, when dean reappeared. No sex differences appeared. Tolerance had a small negative correlation with contributing behavior but degree of tolerance, ascendance-submission, and "test anxiety" had no significant bearing upon increments in time volunteered.

Conclusion: Contributing behavior followed Helson's adaptation-level paradigm in being dependent upon status of inducers, experimental conditions, and degree of authoritarianism of contributors reflected in F scale responses.

99 pages. $2.00. Mic 58-4213

THE ATTITUDE OF COLLEGE SOPHOMORES AND SENIORS TOWARD COUNSELING PROCEDURE WITH REFERENCE TO CERTAIN PERSONALITY FACTORS AND PERSONAL PROBLEM FREQUENCY

(Publication No. 25,136)

Sister Mary Elaine Rogers, R.S.M., Ph.D.
St. Louis University, 1957

This study explores the counseling preferences of sophomore and senior private and public college and university students; it also investigates the personality of the college student--especially in the area of dominance-submission and introversion-extroversion, and the type and number of the student's problems.

In investigating the factors which affect counseling procedure preference, the writer assumed that there are individual differences in preference for type of counseling procedure. This basic assumption and its attendant inquiry raised specific questions which were investigated. Three tests--The Rogers' Interview Reaction Scale, the Bernreuter Personality Inventory, and the Minnesota Problem Check List--were administered to a random population of 2,020 college sophomore and senior men and women. The following conclusions emerged from the study:

1) The experimental population of college sophomores and seniors in this study manifested a strong preference for directive counseling procedures.

2) There is a consistent and strong trend for sophomores to prefer more directive procedures than seniors. College year level plays an important role in influencing counseling choice. The preference, among men and women, moves progressively toward a less directive approach as these students advance in college year level. The difference between the two college year levels is always statistically significant at the 1% and 5% level of confidence.

3) The factor of sex (men versus women) has an influence. Men prefer more directive counseling procedures than do women. In the private colleges the differences are not statistically significant, but in the public colleges and universities the differences are significant at the 1% and 5% confidence levels.

4) In this study size of college or university does not have any discernible relation to expressed preference for a given counseling procedure.

5) The factor of type of college or university also emerges as a strong element. Private school students tend more significantly toward the directive framework than do public school students. Among women all differences are significant at the 1% confidence level.

6) There is a slight tendency for the nondirective groups to be more dominant than the directive groups, but none of the differences is statistically significant.

7) There is a slight tendency for all male nondirective groups to be somewhat more extroverted than the directive groups, but none of the differences is statistically significant. Among women the tendency is in the opposite direction; the large directive groups are in every instance more extroverted than their nondirective female peers. All the differences are significant at the 1% level of confidence.

8) There appears to be no cluster of problems or single type of problem more characteristic of one group than of another. As a general group tendency, students

manifesting a directive preference seem to be characterized by a stronger problem frequency rate than students with a nondirective inclination; however, private college women preferring nondirective techniques admit a high frequency of problems in contrast to the other nondirective groups.

Public college students appear to have consulted counselors about their problems more frequently than private college students; however, the difference seems to be slight.

9) Is there any difference in the preferences of college and high school students? Data on high school students are taken from the Reverend Trafford P. Maher's, S.J., dissertation.

Among both the male and female population high school students are more directive in counseling procedure choices than college students. These differences are all statistically significant at the 1% and 5% levels of confidence. 165 pages. $2.20. Mic 58-4214

THE ABILITY OF EIGHTH GRADE PUPILS TO INDICATE UNDERSTANDINGS OF THREE SIMPLE MACHINES

(Publication No. 24,986)

Milton Rosenberg, Ph.D.
New York University, 1957

This investigation deals with the ability of selected eighth grade pupils to locate relationships within the lever, wheel and axle, and/or pulley; to state these relationships numerically and verbally; and to relate graphically and verbally a lever to a wheel and axle, and a wheel and axle to a pulley.

The test design involved three series of flap-covered diagrams of the machines. The pupil wrote his response on a removable flap. After removal of the flap, he was given the correct answer. This process was continued so that he could examine a series of correct responses in order to check his method or to use them as aids in solving subsequent problems. He stated his method numerically and his understanding verbally. He was asked also to relate graphically and verbally a lever to a wheel and axle, and a wheel and axle to a pulley. This resulted in a total of thirteen separate abilities and a total score. Pretests revealed that the children tested were not familiar with the relationships within and between the machines.

Relationships of the thirteen abilities and the total score to sex, I.Q., and scores on the Differential Aptitude Tests of Verbal Reasoning, Numerical Ability, Abstract Reasoning, Space Relations, and Mechanical Reasoning, were determined by appropriate statistical means.

Results showed that boys and girls were equally capable of indicating the thirteen separate abilities and equally successful in total score.

Although there is insufficient evidence to predict an individual's performance, it was found that pupils in those groups that had higher I.Q.s or higher scores on the Differential Aptitude Tests were more successful than pupils in lower scoring groups.

Of the seventy-eight comparisons between the thirteen abilities and the continuous variables, fifty-five show significant relationships at the .01 level, thirteen show significant relationships at the .05 level, and there is not enough evidence to reject the null hypothesis for ten of the relationships. Nine of these ten involved the pulley. Coefficients of correlation of .37 to .55 between the six continuous variables and total score are significant at the .01 level.

The highest relationships are between the abilities and the I.Q. and the Differential Aptitude Test-Abstract Reasoning; the lowest relationship is between the abilities and the Differential Aptitude Test-Space Relations.

Pupils tested saw relationships between the lever and the wheel and axle better than they saw relationships between the wheel and axle and the pulley. The fact that ninety-eight percent of the pupils who succeeded in indicating numerical understanding of the lever were successful in indicating numerical understanding of the wheel and axle might indicate transfer. Over fifty-five percent of the pupils tested were able to relate a lever to a wheel and axle pictorially; thirty-six percent were able to relate a wheel and axle to a pulley pictorially.

Success in indicating and stating numerical relationships was greater than success in verbalizing relationships. Very few pupils were able to express verbal relationships involving the pulley.

There is evidence that many pupils of little ability, as measured by the intelligence tests and the Differential Aptitude Tests, were capable of solving the kinds of problems involved in this investigation.

Children did discover relationships. There were enough variations in their methods to question the right to teach the "easy" way or the "best" way. The apparent willingness of the pupils to try to find the "answer" and their obvious satisfaction when they did, may warrant the use of similar techniques in the teaching of science principles by pupil discovery. 195 pages. $2.55. Mic 58-4215

STUDIES IN MEASUREMENT OF ODOR PREFERENCES AND IN THEMATIC APPERCEPTIVE RESPONSES TO ODORS

(Publication No. 24,989)

Regina Wallace Turk, Ph.D.
New York University, 1957

The problem of this study involved two descriptive studies in olfaction. Problem I relates to the measurement of preference rankings for a series of odors which are chemically pure and of known chemical composition, and to a study of age and sex differences in such preference rankings.

Problem II of this study relates to the development of a technique of eliciting thematic apperceptive responses by using stimuli which involve pure odor types.

The subjects for Problem I were ninety-six volunteers from the High School and Junior High Schools of Danbury, Connecticut, from the Danbury State Teachers College, and from New York University. They were represented by at least ten males and ten females from each of the following age groups: 12 to 16, 17 to 21, 22 to 26, and 27 to 31.

A series of twelve pure chemical odorants,

representative of food, body and excreta types, was presented to the subjects and they were asked to rank the odors in order of preference from number one, the most liked, to number twelve, the least liked. These preference rankings were then subjected to statistical analysis to find out if there were any significant sex and age differences in odor preference ratings. Significance was accepted at the five percent probability level. Significant differences in preference rankings between the sexes of the same age groups, and between adjacent age groups of the same sex, were found in a number of cases involving odors from the food, body, or excreta types.

In general, the food odors were most preferred, while the body odors and excreta odors were the least preferred. While preference for body odors increased with age for males, the preference decreased for females.

The subjects for Problem II were forty volunteers of the age groups 12 to 16, 17 to 21, 22 to 26, and 27 to 31, five of each sex in each group. These subjects were selected for a study of thematic apperceptive responses to four of the twelve odorants which showed the greatest preference stability. Five members of each age and sex group were presented with the odors and were asked to make up a story involving the perception of the odors.

The stories which were writtten were analyzed for theme content, for the characteristics of the hero, and for the subjects' identification with the hero. In addition the themes were categorized according to food, body, and excreta types. While the stories gave material showing that each subject responded to the stimuli according to his own needs and drives, giving clinical information as to his personality, no statistically significant categorizations of themes could be made on the basis of sex and age groupings.

The results were discussed with respect to theory of perception and to clinical implications. The discussion on perception considered the interaction between personality and odor types and the possibility of the influence of this personality effect on other perceptual tasks.

The discussion on the clinical implications centered on the types of themes evoked by the various odor groups. The food odors, in general, presented themes that evoked pleasant memories of childhood experiences, while the body and excreta odors frequently evoked themes involving aggression, frustration, hostility on the part of the heroes, and the outcomes of the stories were generally unpleasant and depressing. 136 pages. $2.00. Mic 58-4216

EDUCATION, TEACHER TRAINING

A PROPOSAL FOR THE MAINTENANCE AND IMPROVEMENT OF EFFECTIVE INSTRUCTION IN HOME ECONOMICS AT THE COLLEGE LEVEL

(Publication No. 24,093)

Geraldine Clewell, Ph.D.
The Ohio State University, 1952

The importance of effective instruction in college home economics courses rests on the need to produce students who can participate intelligently in democratic living and who are capable of assuming responsibility to improve that living for all. Home economics in higher education will make its contribution through helping people examine their beliefs and habits of thinking concerning family life, through aiding them to establish and evolve a family pattern suited to the modern world, and through developing abilities for a vocation which makes special use of home economics training.

When a home economics staff engages in a program of self-evaluation, it is inevitable that the effectiveness of the teaching will come under scrutiny. No doubt teachers will want to improve weaknesses found and to maintain whatever strengths are discovered. The manner in which teachers in service may work together, or individually, to improve their own professional education was the problem that led to this study. The over-all purpose of the study was to make suggestions to home economics administrators and teachers who have the responsibility of promoting inservice practices for the improvement of instruction. Secondary purposes were: (1) to increase awareness of practices which may be employed in an inservice program; and (2) to experiment with a check list device to determine its efficiency in locating teacher concern for the improvement of instruction, and, at the same time, to increase staff interest in good teaching.

A belief in the inherent value of the application of democratic principles to all activities directed the procedure of the study. This procedure was based on the hypothesis that reliable sources of information would be (1) the extent of participation of individual staff members in inservice practices; (2) an evaluation of the effectiveness of those practices for the improvement of teaching; and (3) the reaction of staff members to activities which promise to promote effective teaching.

The responses of 98 home economics administrators to a survey sheet proved encouraging. Ninety-two per cent of the group indicated that provision for some types of inservice education at their institutions had been made. Only 5 per cent said they were not planning to continue what had been begun or were going to emphasize other activities the following year. In general, the programs were making progress. The practices initiated in the past, and planned for the coming year, were most often workshops and study groups. Faculty meetings and committee work were reported in a few less instances. The fact that most of the activities had emphasized curriculum study further augments the need to center attention on teaching methods and techniques.

More detailed information relative to participation in, and the value of, inservice practices for improving teaching was supplied by 554 check lists returned by home economics staff members. The respondents represented 67 institutions. The check list used in this study was quite specific, providing teachers and administrators with the opportunity to consider inservice practices--for example, staff meetings, orientation of new staff members, co-planning of courses, or contacts with students--and to identify those which had been experienced and which were believed would be effective if available for use. The respondents also had an opportunity to express their opinions relative to the activities important for effective teaching. The most significant conclusions that may be drawn from these data are:

1. Inservice practices are being promoted either by individuals or institutions in home economics units of all

sizes. Each practice included in the check list was reported to have been experienced by some staff members. Over half of the group reported participation in all but three of the practices. The range in number of individuals who reported participation in various practices was from 98 per cent for one or more of the sub-practices in the "use of professional library and materials" to a low of 30 per cent for "supervision of classes and of teaching" by either a senior staff member or a dean of instruction.

2. The inservice practices experienced have not been a part of an organized or planned program. Often they were not directed toward a consideration of teaching.

3. Teachers and administrators are interested and are ready to participate in inservice practices that will help them improve teaching. The number of practices left unchecked was small; the range was from five to 81 for any one practice.

4. The size of the home economics unit does not make any appreciable difference in the practices provided or in their possible effectiveness, though the personnel taking part in certain group practices varies slightly according to the number of home economics staff members employed. For instance, fewer small unit teachers have participated in course-area staff meetings, or on home economics committees, than have staff members in larger units.

5. Little improvement in the effectiveness of teaching can be expected until the administrators and the teachers both are interested enough to give time and effort to the promotion of inservice programs. This was shown by the fact that practices most commonly used were those which are accepted as a part of the usual activities of teaching not calling for the use of additional time on the part of staff members. Also, conditions listed as favorable to the promotion of practices for the improvement of instruction were most often described as freedom in teaching, staff cooperation and interest in improvement, services and resources available and used, and an interested and cooperative administration. The conditions thought to present difficulties in the promotion of inservice practices most often were referred to as a lack of time, inadequate or undersirable space and equipment, and departmentalization within the program. The most likely sources of leadership for the promotion of inservice practices were believed to be the head of the unit and the individual.

6. The check of inservice practices provided a satisfactory means of locating acceptable ways staff members may continue professional education. The acceptability of inservice practices, as revealed by the check on the effectiveness of the devices listed under each practice and on the average extent of participation in the devices, indicated that: "co-teaching and co-planning of courses" and "participation in community activities" were rated highest in terms of effectiveness but were ranked as fourth and seventh in the number of times experience with each was reported. Most often reported as practices in which staff members had participated were "staff participation in determining policies" and "professional organization membership." These were both rated fifth in terms of effectiveness. Least often checked in terms of effectiveness and participation were: "committee membership"; "class visits to observe technique of others"; "evaluation of teaching"; "workshops, special course, or seminar to study teaching"; and "supervision of classes and of teaching." Respondents showed a reluctance to accept and engage in a practice which might be interpreted as an interference with academic freedom. Practices reported to be "ineffective" or "very ineffective" by the highest percentage of responses were those which suggest infringement on intellectual freedom or a questioning of the individual teacher's ability to teach as he wishes.

7. A comparatively small percentage of respondents listed improvements in teaching which were attributed to participation in inservice practices. A total of 27 per cent mentioned some improvement in use of methods or new techniques. Nineteen per cent indicated a form of personal improvement, such as a change in attitude toward teaching or more ease in class situations.

8. Over half of the respondents indicated that 47 of the 69 activities in the check list are essential for effective teaching but represented activities for which either no help was needed or desired at the present time. One or more of the activities classified as a part of the evaluation of teaching were checked by 43 per cent of the group as activities for which help was desired; and activities of both planning for teaching and setting up objectives were checked in this manner by 39 per cent of those responding. Comparatively few activities were left unchecked, although teachers tended to leave items blank rather than to indicate that the activities are either "impractical" or "unessential." Ten or more individuals indicated that all of the activities included in planning are "impractical"; but only half of these same activities were checked by ten or more teachers as "unessential." Seven of the ten activities included in establishing good student-teacher relationships were considered "unessential" by ten or more respondents.

9. A check list device is a valuable means for determining which teaching activities need improvement. It not only served to locate teacher concern, but it also located activities which are not clearly understood or recognized as important for effective teaching. The general acceptance of the check list used in this study and the specific way in which it served its purpose leads to the conclusion that this device, or a similar one, would prove of value as an inservice practice for the improvement of teaching.

The analysis of the findings of the study, in terms of those who are responsible for the promotion of inservice programs for the improvement of teaching, led to the following suggestions:

1. Staff members need to give serious consideration to the establishment and promotion of a planned program for aiding home economics teachers maintain or improve the effectiveness of college instruction. A part of this planned program should be the use of a device to present an over-view of the various practices which may properly comprise the total inservice programs.

2. Plans for the inservice professional growth of teachers should include provision of a variety of practices or ways through which staff members may be aided in improving their instruction.

3. Opportunity should be provided for groups of individuals with allied interests to work together in the study of ways to improve teaching.

4. Administrators and teachers should strive to create conditions which are conducive to the promotion of inservice professional growth of teachers. This will include: (a) the development of an atmosphere which reflects interest in teaching, willingness to improve, cooperation, and freedom to experiment; (b) a permissive administrative attitude and the application of democratic principles of association; (c) the adjustment of time and schedule

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factors; (d) the provision of leadership and encouragement for the individual to assume leadership for himself and for the group; (e) the creation of an atmosphere and working conditions which result in desirable student qualities; (f) an effort to eliminate handicaps of space and equipment; and (g) the provision of services and materials which incourage participation.

5. The inservice program for professional growth should include some means of locating teacher concern for improvement and for determining promising points of emphasis for study.

6. Some provision needs to be made for the continuous evaluation of progress in the improvement of teaching.

Guides for the selection of specific inservice practices were listed in relation to the rank of each according to the extent of participation reported and the rating which was given each in terms of effectiveness. Guides for practices promoted by the institution for groups of staff members are: (1) continue and extend staff participation in determining policies and objectives; (2) provide for home economics and course-area staff meetings, and make use of institution-wide faculty meetings when they are planned and directed toward a consideration of teaching problems; (3) prepare and distribute institutional bulletins, newsletters, and similar publications, with an emphasis on having them deal with teaching problems, and on timeliness; (4) re-examine the practice of orientation of new faculty members in order to increase the effectiveness of its use; (5) promote committee membership, generally on home economics staff committees, but also endeavor to extend this practice to include non-home economics personnel; (6) provide adequate services and materials--secretarial services, audio-visual aids, guidance center services, testing services, and consultative personnel services; (7) introduce workshops, special courses, and conferences, and adjust schedules to permit participation easily; and (8) study the value of supervision of teaching when it is a cooperative undertaking.

Guides for the selection and use of inservice practices which may or may not be promoted by the institution, but which should be encouraged for small groups or individuals, are: (1) continue the encouragement of membership in professional organizations and seek ways to facilitate attendance at professional meetings; (2) continue and increase the use of professional library and materials--books available in the campus library, staff exchange of books, provision of a browsing room or shelf, and some group study of common materials; (3) encourage co-planning and co-teaching of sections or courses in sequence where enough of the staff are available for participation in this practice; (4) emphasize contacts with students, with increased participation, especially for new staff members, in serving as sponsors of extra-class activities; (5) continue and increase teacher participation in community activities; (6) extend opportunities for individual conferences between the administrator and one or more staff members; (7) promote research in the study of teaching, and especially emphasize the use of research findings as these are available in the literature; (8) study the use of evaluation of teaching as a practice; and (9) aid staff members, new members especially, to use the practice of visiting the classes of teachers known to be effective.

Seven recommendations for furthering inservice programs and for the study of effective teaching were submitted on the basis of the findings and in relationship to the limitations of the present study. These are:

1. The development of an inservice program for the maintenance and improvement of effective teaching should be extended to more home economics units and it should involve all staff members. This means the acceptance of a challenge (a) to provide group activities and services or materials as the foundation of the program, and (b) to create conditions which will encourage all staff members to participate in group and individual inservice practices.

2. Consideration should be given by each staff member, and by the profession as a whole, to the relation of effective teaching to the basic purpose of home economics education--improved personal, home and family living. A general interest exists but this needs to be extended to more teachers and elevated to an intellectualized participation in practices in order that each may better his contribution.

3. Further effort should be expended toward the development of an increased staff awareness of the many ways in which progress has been made, and of the variety of practices which may be employed as means of helping each faculty member, and the total group, improve teaching in home economics.

4. Experimentation and study of each practice in the light of the characteristics of a successful inservice program should be promoted.

5. The use of a check list of activities basic for effective teaching should be continued as a part of an inservice program for the professional growth of teachers.

6. The check list of teaching activities should be further tested and modified through experimental use by faculty groups. The value of the device to serve intended purposes will be increased as the group establishes the purpose, devises a suitable code, and discusses the meaning of the statements included.

7. Further study of activities important for effective teaching should be promoted. Related investigations involving the use of the check list device might be: (1) to obtain the reaction of students to the need for improvement and to the success with which teachers employ the activities in their teaching; (2) adaptation of the check list for use in the preservice training of college and secondary teachers; (3) to determine the extent to which actual use is made of various acceptable teaching activities; and (4) to study the ways acceptable activities are employed by those whose teaching is effective.

The acceptance of the improvement of teaching in home economics as a vital institutional goal will depend on the interest of both administrators and teachers. Once the challenge to improve teaching is accepted the focal point of concern will be the procedure through which the group progresses toward bringing about improvement. The availability and use of inservice practices is one way of furthering an improvement of teaching. The extent to which each individual enters into the planning of the program and into its execution should be a matter of basic concern. Only when all accept the responsibility to intellectualize the practices in which they cooperatively engage as they study teaching will the inservice program be an experience that demonstrates the operation of democratic principles in human relationships. When this happens, an inservice program that will lead to more effective teaching in home economics at the college level will result.

295 pages. $3.80. Mic 58-4217

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AN EXPERIMENTAL STUDY OF SELECTED FACTORS IMPORTANT IN SUCCESSFUL TEACHING

(Publication No. 24,824)

Bernard Keith Clinker, Ed.D.
Indiana University, 1957

Chairman: Philip Peak

The problem of this research was to determine the differences between two groups of 1953 teacher graduates of Ball State Teachers College, Muncie, Indiana with regard to certain factors associated with successful teaching. The 115 teachers were divided into two groups on the basis of success ratings given them by their superintendents, principals, and supervisors during two years of teaching.

The success ratings compiled in 1954 by Ball State Teachers College for beginning teachers were obtained, and second ratings by superintendents, principals, and supervisors of the teachers taking part in the study were obtained during the spring of 1955 by this investigator.

A 10-point rating scale was used. The 57 individuals having a mean rank between 2.00 and 7.50 were placed in a "less successful" group, and the 58 with a mean rank betweeen 7.75 and 10.00 were placed in a "highly successful" group. As a group, the less successful teachers had a mean success rating of 6.27 as compared with a mean success rating of 8.61 for the highly successful group.

The factors under consideration were: (1) attitude of teachers toward pupils as measured by the Minnesota Teacher Attitude Inventory, (2) personal problems of teachers as indicated by the Mooney Problem Check List, (3) scholastic aptitude of teachers as measured by the American Council on Education Psychological Examination, and (4) scholastic achievement of teachers as indicated by college grade-point averages. Data regarding grades and ACE centiles were obtained from the college records. MTAI scores during the senior year of college were obtained from Duane Sandgren, who did a study in 1953 using most of the individuals of this same group. A second set of MTAI scores were obtained directly by this investigator during the process of this study in 1955. Results of the MPCL, administered during this study were also compiled.

Group means for the various factors were computed, and the means of the highly successful group were compared with those of the less successful group. Significance of the difference between means was determined by the t test.

The highly successful group had consistently higher mean scores in scholastic aptitude, scholastic achievement, and attitude toward pupils, and indicated fewer problems (with the exception of "sex"), than did the less successful group. However, only in scholastic achievement (all subjects), and in problems relating to health, self-improvement, personality, and home and family were the differences significant at the five percent level or above.

With regard to MTAI scores, it was noted that both groups had lower scores after two years of teaching than before teaching. The drop in mean score for the highly successful group was significant at the five percent level, while for the less successful group it was not significant.

It was observed that the mean success rating of the highly successful group increased the second year of teaching, while that of the less successful group decreased. In neither case, however, was there significance at the five percent level or above.

It was concluded that, of the factors considered, only the scholastic grade-point averages for all subjects and the numbers of problems checked on the Mooney Problem Check List (areas involving health, self-improvement, personality, and home and family) were shown to be significantly differentiated between the two groups of teachers, the highly successful group having a higher mean grade-point average and a lower number of problems checked.

109 pages. $2.00. Mic 58-4218

PERCEPTIONS OF FUNCTIONS AND COMPETENCIES OF SECONDARY HEALTH EDUCATORS

(Publication No. 25,346)

Claude Trabue Cook, Ed.D.
Stanford University, 1957

The purpose of this study was to determine the areas of needed emphases in the health education curricula in the teacher-training institutions in Oregon.

The policies and principles for the improvement of professional preparation first promulgated at the Jackson's Mill Conference were adapted as the basis for recommended standards in teacher education in school health in Oregon. The Necessary Functions and Competencies of Health Educators provided the list of teacher activities and responsibilities for the construction of a check-list in which the personnel involved with the instruction and administration of school health programs could express their perceptions of the role of the secondary health educator in Oregon schools. The school personnel sampled were secondary health teachers, high school principals, and supervisors of programs of school health.

The check-list containing eighty-two items was divided into three main parts related to the school health program: (1) Health Services, (2) Health Education, and (3) Healthful School Living.

CONCLUSIONS

The following conclusions resulted from this study:

First, there was substantial agreement among the three groups of judges in their perceptions of the criterion, importance of the functions and competencies of a health educator, particularly in regard to the area of Health Education. However, within this general consensus of agreement two kinds of differences were apparent:

There seemed to be a slight tendency for principals and supervisors to attach value to more aspects of the total school health program than did teachers, and

Principals attached more value to the importance of the area of Health Services than did either teachers or supervisors.

Second, although there was substantial agreement among the three groups of judges relative to the practices and policies in the conduct of the total school health program certain characteristic differences became apparent:

Teachers and supervisors tended to agree more closely in their perceptions of the policies governing school health programs and in their perceptions of the extent to which they were practiced.

Principals perceived the role of the health educator in

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the area of Healthful School Living as being one which should emphasize the social, emotional, and the physical aspects of the student's health environment; the health educator as perceived by the principals should not be concerned with (1) facilities, (2) maintenance, and (3) contact with the community; and furthermore, the principals perceived the health educator's role as performing those tasks "expected of health personnel" until they approach areas perceived by the principal as being in the area of the school administrator's responsibility.

Teachers perceived themselves as having few responsibilities in the area of Health Services above and beyond their responsibilities in first-aid and emergency care of the students.

Third, responsibilities of the health educator which have been continually emphasized by the profession in recommendations stemming from the various national conferences concerned with the functions of the health educator were obvious in this study by their omission from significant ratings by the three groups of judges, particularly the health teacher. The omissions were predominately from the areas of Health Services and Healthful School Living.

Fourth, teachers perceived their job as being teachers in the area of Health Education with little responsibility in the field of Health Services and Healthful School Living.

This perception of their role in the school health programs was in accord with that of the other two groups, particularly the principal's. The health teacher's responsibility, as seen by these three groups of judges, was that of a classroom instructor, a director of learning of health facts and knowledge. 212 pages. $2.75. Mic 58-4219

FACTORS AFFECTING TEACHING LEVEL PREFERENCES IN NEW YORK CITY SECONDARY SCHOOLS

(Publication No. 25,491)

Bernard Eugene Donovan, Ed.D.
New York University, 1957

THE PROBLEM AND ITS IMPORTANCE

The purpose of the investigation was to analyze factors affecting the preferences of certain teachers for service in the junior or senior high schools of New York City and to make recommendations which might help to overcome the disadvantageous factors of the less desirable level. The study was considered important because of the great shortage of qualified teachers in the city's junior high schools and the constant changing of teachers from the junior-high-school level to the senior-high-school level.

HISTORICAL BACKGROUND

Although there have been many studies in the field of teacher training and selection, there is only scanty reference to teachers' preferences for the junior or senior level of secondary-school teaching. Certain of these studies considered the need for properly trained junior-high-school teachers, the effect of college training on the choice of elementary or secondary levels of teaching, the failure of the colleges to prepare adequately for junior-high-school teaching, the value of student teaching in junior high school, the need for in-service training and the reactions of individual teachers to teaching service on one or both secondary-school levels. However, no studies were found which considered the several factors which affect teachers' preferences for secondary levels of teaching.

PROCEDURES USED IN THE STUDY

The procedures used in this study were two-fold. One phase required analysis of the regulations and practices governing teaching service in New York City secondary schools to determine any differences in working conditions between the junior-high-school and senior-high-school levels. Analysis was also made of the teacher-preparation programs of fifteen metropolitan New York teacher-training institutions.

The second phase of the study was concerned with the opinions of teachers and principals. Questionnaires, supplemented by scattered interviews, were used to question 246 teachers who changed secondary levels between 1950 and 1955, the 83 principals of the junior high schools these teachers left, 250 secondary teachers who did not change levels and 684 student teachers preparing for secondary-school teaching.

CONCLUSIONS

The teachers were divided in their preferences for secondary-school teaching levels but the greater number of teachers indicated a preference for the older adolescents and more rigorous subject matter of the senior-high-school level. Competent, sympathetic supervision, including a program of planned assistance for new teachers was reported to be provided more adequately in senior high school.

Inadequate preparation for junior-high-school teaching, lack of prestige, disciplinary problems of early adolescence, the heavier teaching load and the greater amount of out-of-license teaching in the city's junior high schools were cited by these teachers as factors which influenced them to prefer senior-high-school teaching.

RECOMMENDATIONS

Junior-high-school teaching in New York City should be made more attractive by equalizing the teaching load with that of the senior high school, reducing out-of-license teaching, strengthening the supervisory program, providing additional specialized personnel to handle the problems attendant upon early adolescence and organizing a planned program of assistance for newly appointed teachers. The prestige of junior-high-school teaching should be raised and teacher-training institutions should give more attention to the junior-high-school level in their preparation of secondary-school teachers.

IMPLICATIONS OF THE STUDY

There is need for continued study of the problems involved in teaching service in secondary schools, particularly on the junior-high-school level.

The responses of the teachers participating in the study also indicate need for additional research in the areas of secondary-school teaching load, discipline, core curriculum, supervisory practices and orientation of new teachers. 180 pages. $2.35. Mic 58-4220

AN ANALYSIS OF SELECTED CHARACTERISTICS RELATED TO THE SUCCESS OF GRADUATES IN ELEMENTARY EDUCATION AT BALL STATE TEACHERS COLLEGE

(Publication No. 24,825)

Peter G. Fast, Ed.D.
Indiana University, 1957

Chairman: Hanne J. Hicks

The Problem. The purpose of this study was to determine the significant differences among the most successful, average, and least successful students, compared on selected characteristics related to the collegiate success of 92 graduates on the elementary education curriculum at Ball State Teachers College.

Methods and Procedures. Success in college was defined in terms of four criteria: scholastic achievement, self-adjustment, peer-social acceptance, and rating in student teaching. Variables used with each success criterion were scores on a sophomore English test, rating of teaching potential, grades in professional education courses, grades in methods courses, grades in activity courses, the time when the student first decided to become an elementary teacher, the predominant circumstance influencing his decision, and the major reason for entering the teaching profession. Each of the success criteria was used as a variable when compared with a major success criterion.

The population consisted of 92 seniors on the elementary education curriculum who graduated at Ball State Teachers College in June, 1955. This population represented the number of subjects for whom complete records were available for the characteristics studied. The subjects were classified into three groups namely, high, middle, and low in terms of data collected on each of the four criteria of college success.

Data relative to scholastic achievement were gathered from the student's personnel folders and transcripts. Responses on the Mooney Problem Check List were analyzed in an effort to determine each student's status of self-adjustment. A peer-social acceptance scale was constructed and administered to ascertain the degree of social acceptability among classmates. The Student Teaching Report provided an evaluation of each person's performance as a student teacher.

Information concerning the time when each student first decided to become an elementary teacher, the predominant circumstance influencing his decision and the major reason for entering the teaching profession were secured by administering a personal questionnaire to those cooperating in the study.

In terms of the four success criteria, data collected were tabulated, analyzed, and interpreted. The three groups were compared on nine variables and the significance of the differences was tested by analysis of variance. Discrete data were analyzed in terms of actual number and per cents.

Conclusions. On the basis of the findings in this study, the following conclusions were drawn:

1. Perspective teachers with higher scholastic records tend to receive correspondingly higher ratings in student teaching, scores on a sophomore English test, potential teacher ratings, grades in professional education courses, and grades in methods courses.
2. Self-adjustment and peer-social acceptance in themselves did not seem to bear a significant relationship to scholastic success in college, peer-social acceptance, student teacher ratings, sophomore English scores, potential teaching ability, grades in professional education courses, grades in methods courses, and grades in activity courses. However, there seems to be some relationship between self-adjustment, peer-social acceptance and the characteristics studied.
3. Prospective teachers with higher ratings in student teaching tend to receive correspondingly higher scholastic averages, potential teacher ratings, and grades in professional education courses, grades in methods courses, and grades in activity courses.
4. Generally speaking, the performance of students in the low group appeared to show a greater degree of consistency among the factors measured than was true of the corresponding performance of students in the high group.
5. Prospective elementary teachers tend to select their professional careers during their senior high school years.
6. Interest in people appears to be the major incentive of prospective teachers to enter the profession.

147 pages. $2.00. Mic 58-4221

CURRICULUM LABORATORIES IN COLLEGES OF TEACHER EDUCATION

(Publication No. 24,826)

Royce Pendleton Flandro, Ed.D.
Indiana University, 1957

Chairman: Carolyn Guss, Ed.D.

The purpose of this study was to discover the status of curriculum laboratories in colleges of teacher education in the United States with special emphasis upon curriculum development functions and relationships with other agencies, and to ascertain the opinions of curriculum laboratory directors regarding the operation and future development of such laboratories.

Methods, Procedures, and Sources of Data

A working definition of curriculum laboratories was developed and sent in a postal card questionnaire to deans of 396 colleges of teacher education in the United States asking them to indicate whether or not they had such a curriculum laboratory. A second questionnaire was developed and mailed to the curriculum laboratory directors of the 140 institutions reporting a curriculum laboratory. Of the 100 laboratories from which responses were received, 78 questionnaires which could be tabulated were divided into two groups according to whether or not curriculum revision and development was reported as a function of the curriculum laboratory. These two groups were compared as to the various aspects of curriculum laboratories being studied. Opinions and suggestions of curriculum laboratory directors were also obtained and analyzed.

Conclusions

At least one-fifth of the colleges of teacher education in the United States provided curriculum laboratories of

many varieties and types. Two basic types are discernible --those which develop and revise curriculum and those which do not. The majority (58 per cent) conduct curriculum study and revision in addition to providing curriculum materials. Both types emphasize the provision of materials, but those which develop curriculum generally have a broader offering of facilities, materials, and services and tend to be older and more often affiliated with departments of instruction and research, while those which do not develop curriculum are more often affiliated with libraries and materials centers and have fewer relationships with other agencies. Directors indicate that curriculum laboratories should exchange materials, maintain close liaison and lines of communication, as well as, work together on the same curriculum problems with the teacher preparation departments, libraries, audio-visual centers, testing and research centers, public schools, and other curriculum laboratories. Directors also indicate that the curriculum laboratory should exercise more leadership in the development of curriculum and that the facilities, materials, and staff should be enhanced as to quantity and quality, in order to provide more field and research services, production of curriculum materials, teaching of curriculum building, coordination of services of other agencies for curriculum revision and study, and meeting the specific curriculum needs of the primary users who are pre-service and in-service teachers. 240 pages. $3.10. Mic 58-4222

PERSONAL AND PROFESSIONAL RELATIONSHIPS BETWEEN SUPERVISING TEACHERS AND STUDENT TEACHERS

(Publication No. 24,468)

George Perkins Freeman, Ed.D.
George Peabody College for Teachers, 1957

Major Professor: E. L. Lindman

The purpose of this study was to determine factors which supervising teachers, student teachers, and directors of student teaching had found to be significant in improving personal and professional relationships between supervising teachers and student teachers and, using these factors, to evolve a list of principles which could be employed by supervisors to promote desirable relationships.

The critical incident technique was employed to determine specific factors which supervising teachers, student teachers, and directors of student teaching believed to be most effective for them in developing desirable relationships between supervising teachers and student teachers. Responses were procured from two student teachers, two supervising teachers, and a director of student teaching in each of thirteen institutions located in the states of Arkansas, Texas, and Louisiana. Even though no attempt was made to procure a representative group of teacher training institutions, the sample included public and private universities, segregated and integrated institutions, and multiple-purpose, state-supported institutions. The descriptions given by the respondents included factors relative to (1) the organization and administration, (2) the assignment, (3) the induction and participation, and (4) the evaluation of student teachers.

The respondents considered effective personal and professional relationships essential at all stages of the student teaching experience.

Varied backgrounds of experience and capacity produced individual differences among student teachers which were readily observed. Activities employed for improving relations in one situation were not applicable to a different student teacher in another situation. These differences indicated that a set pattern of training will not suffice for all student teachers.

Factors thought to be significant tended to focus on student teacher achievement and acceptance. Involved in acceptance was the student teacher's desire for status in which responsibilities and privileges were clearly defined. Most respondents placed emphasis on the advantages which inhere in a friendly, permissive climate. This climate was developed through the informal, cooperative undertakings of the supervising teacher and the student teacher. Relationships were enhanced when student teachers were inducted gradually through a series of progressively more difficult experiences. Relationships, in general, improved in proportion to the amount of time made available for the student teacher to work with the supervising teacher.

The descriptions presented in the study were used to evolve principles which may serve as guides to the supervising teacher in his efforts to establish effective personal and professional relationships with his student teachers. The principles incorporate the following factors: (1) cooperative planning developed better understanding for all personnel; (2) clearly defined roles reduced friction and misunderstandings; (3) organization and administration often determined opportunities for good relationships; (4) increased time for conferences improved rapport; (5) maturity and adequate background of experiences provided readiness for teaching; (6) cooperatively developed assignments caused students to feel wanted; (7) previous opportunities to become acquainted made rapport easier; (8) conscious effort to promote relationships produced effective results;. (9) assignments based on student's weaknesses proved effective; (10) increased responsibility for teaching resulted in improved relations; (11) student teacher choice of initial teaching activity increased confidence; (12) opportunities to use own ideas increased student teacher enthusiasm; (13) experiences outside the classroom sometimes proved more effective than classroom instruction; and (14) informal evaluation techniques made the supervising teacher a more approachable individual to the student teacher.

249 pages. $3.25. Mic 58-4223

PROFESSIONAL LABORATORY EXPERIENCES PROVIDED FOR GRADUATE STUDENTS IN ELEMENTARY EDUCATION

(Publication No. 24,479)

Dell Clifford Kjer, Ph.D.
George Peabody College for Teachers, 1957

Major Professor: Maycie K. Southall

This study sought to describe and analyze the professional laboratory experiences which selected graduate

institutions provide for students preparing to become elementary teachers, principals, supervisors, and college teachers of elementary education. Four aspects of the problem were studied: (1) the types of professional laboratory experiences provided; (2) the experiences considered most valuable; (3) their organization, administration, supervision, and evaluation; and (4) the school and community facilities utilized. The term professional laboratory experiences was defined as the practical firsthand experiences which bring students into direct contact with children, youth, and adults, in actual teaching-learning situations in the school, home, and community.

The survey method was used and included the following steps: (1) formulating the problem, (2) selecting the institutions to be studied, (3) constructing a survey instrument, (4) collecting the data, and (5) organizing and interpreting the findings.

The data-gathering instrument was composed of two parts -- a check list designed to collect information regarding types of professional laboratory experiences provided, the proportion of graduate students receiving each experience, and the experiences considered among the most valuable for students; and a guide sheet on which respondents were asked to write descriptions of one or more of the most valuable laboratory experiences in which they had guided graduate students of elementary education. The sampling for the study consisted of 180 college teachers representing thirty-seven selected graduate institutions, located in twenty-four states and the District of Columbia. Of this number, 55.56 per cent responded with usable answers, 50 per cent completing Part I and 42.22 per cent Part II of the survey instrument.

Six major types of professional laboratory experiences were provided at the graduate level by a majority of the co-operating instructors, listed here in frequency order: (1) observation; (2) participation; (3) responsible experiences; (4) field trips, excursions, visits, and travel; (5) surveys and research; and (6) participation in professional programs and organizations. The types of direct experiences considered as being most valuable by a majority of the respondents were, in rank order: (1) participation, (2) observation, and (3) responsible experiences.

If the most frequent practices are summarized we find that the laboratory experiences considered among the most valuable for graduate students of elementary education are organized in a separate course specifically designed to provide laboratory experiences. Graduate credit of two or three semester hours is allowed. The experience extends from twelve clock hours per week in the laboratory situation. Regularly schedules class time may or may not be used. No monetary assistance is given students. The experience is co-operatively planned and evaluated by the instructor and students involved, but supervised by a group of faculty members. The major activities involve observation of children in college-controlled situations located within twenty-five miles of the campus.

The author concluded that the general existence of programs of laboratory experiences in outstanding graduate institutions indicates that graduate instructors, faculty councils, and administrators recognize that laboratory experiences are a valuable type of graduate work. The pattern of direct experiences is fairly uniform but lacks stability. The experiences provided depend largely upon individual instructors for their conception and development, and expediency influences those most frequently used. Furthermore, proportionately few graduate students participated even in the most valuable. In fact, professional laboratory experiences at the graduate level seem to depend upon the interests of the guiding instructors; the availability of desirable facilities, supervisory personnel, and time; as well as upon the needs of students.

It is recommended that the responsibility for implementing graduate programs of laboratory experiences for leaders in elementary education be accepted by the faculty and administrative heads of graduate institutions and that co-operative studies by conducted to determine the feasibility and value of organized laboratory experiences as an integral part of the graduate program.

385 pages. $4.95. Mic 58-4224

THE PREPARATION OF COMMUNITY COLLEGE TEACHERS

(Publication No. 25,161)

Leonard Levy, Ed.D.
The University of Texas, 1957

Supervisor: Professor J. W. Reynolds

This is a pilot study intended as an aid to the development of a series of objectives for the specialized curriculum related to the preparation and training of community college instructors. The material was gathered from two primary sources of data: teachers functioning in a community college and teachers engaged in the preparation of junior and community college instructors.

The first set of data for this study was obtained by a survey of the background, experience, preparation, and attitudes of approximately one-hundred members of the faculty of a selected community college. The in-service teachers were studied and compared on the basis of academic and terminal course teaching assignments in order to identify differences in the duties and needs of the two teaching groups. These teachers were contacted by the structured interview technique. The second source of primary information, subject-matter specialists engaged in the training of teachers for the community college level, was composed of the fourteen colleges and universities listed by the American Association of Junior Colleges as providing for work in this field. The schools were contacted by means of a questionnaire.

From a list of differences between the job requirements and the opportunities for preparation available to community college teachers, a list of needs was identified. The courses now being offered by the colleges and universities for the preparation of these instructors were then reviewed to determine how completely the professional needs are currently being met. Finally, a list of needs relative to the preparation of community college instructors was inferred from the differences between the job needs and the needs being met through available preparation for community college teaching.

In making a comparison between those community college teaching needs as reported by the in-service community college instructor and the needs reported by the subject-specialists, training teachers for community college duties, a general agreement was indicated.

In ranking of needs according to the frequency of mention by the in-service and teacher-trainer groups, some notable differences were identified.

The adequacy of the curricula available for the preparation of community college teachers is indicated by an inventory of those in-service teacher's needs stated as being met by each of the teacher-training institutions. While two of the teacher-training institutions provide for fifty per cent or more of the needs, none fulfills all of the needs, and the average teacher-training institution is meeting approximately thirty-six per cent of the needs identified by the in-service community college teacher.

273 pages. $3.55. Mic 58-4225

AN APPRAISAL OF SELECTED ASPECTS OF THE TEACHER EDUCATION PROGRAM AT PHILIPPINE UNION COLLEGE

(Publication No. 24,834)

Raquel Salting Manalaysay, Ed.D.
Indiana University, 1957

Chairman: Howard T. Batchelder

The purpose of this study was to make an appraisal of selected aspects of the undergraduate preparation of secondary school teachers at Philippine Union College based on a follow-up of the secondary teacher education graduates from 1951 to 1956.

Three questionnaires and one check list were constructed and used to collect data relative to (1) the nature of the positions held and work performed by the graduates and of the professional and community activities of the graduates; (2) the reasons why non-teaching graduates did not enter the profession; (3) the judgment of graduates relative to the value and adequacy of the education and psychology courses, the student teaching program, and the selected personnel services of the College; (4) the types and degree of seriousness of the difficulties encountered by the beginning teachers as recognized by them and their principals; (5) the principals' appraisal of the selected characteristics of the beginning teachers under their supervision who graduated from the College; and (6) the objectives of the teacher education program at Philippine Union College.

Among those responding to the questionnaires were 75.8 per cent, of the 91 graduates (of whom 62.3 per cent were teaching and 37.7 per cent were not teaching), 96.1 per cent of the 26 principals, and 80 per cent of the administrators and faculty members in the Department of Education.

The following are some of the conclusions that were warranted by the findings of the study:

1. The beginning teachers who graduated from the College needed to be prepared to teach classes of average size in private schools in rural and suburban areas, to assume normal teaching loads, to sponsor a variety of extra-class activities, and to participate in various community and religious activities.

2. A great majority of the non-teaching graduates who had not taught since graduation from the College would have taught had they been offered a teaching position, and most of those who left the teaching profession would go back to teaching if they were now offered a teaching position.

3. In the judgment of the graduates, student teaching was the most valuable course in the professional sequence; however, the course would have been better if the students had been given the opportunity to do full-time student teaching, to have experience in off-campus student teaching, to do some student teaching in subject fields outside of their major, and to have closer supervision and help from better qualified supervising teachers.

4. The beginning teachers and their principals were in agreement that the majority of the beginning teachers' difficulties were of an instructional nature, but they did not always agree as to the relative seriousness of these difficulties.

5. Although the beginning teachers manifested decided strengths in their adherence to professional ethics, enthusiasm for teaching, and knowledge of subject matter, they lacked preparation in the use of audio-visual materials and equipment.

6. The College administrators and the members of the faculty in the Department of Education at Philippine Union College were in general agreement as to the objectives which should guide the teacher education program.

7. Although some of the objectives of teacher education at Philippine Union College were well achieved by the program, others were only fairly well achieved, and still others were hardly achieved or were not being met at all.

331 pages. $4.25. Mic 58-4226

MIDDLE TENNESSEE STATE COLLEGE: ITS HISTORICAL ASPECTS, AND ITS RELATION TO SIGNIFICANT TEACHER-EDUCATION MOVEMENTS

(Publication No. 24,484)

Homer Pittard, Ed.D.
George Peabody College for Teachers, 1957

Major Professor: E. L. Lindman

The purposes of this study were to describe the origin, growth, programs, and role of an area college, Middle Tennessee State College; to indicate the relationship of this institution to national teacher-education movements, and to examine the population trends and enrollment potential in the area served by this college. The procedure involved a study of histories of education, unpublished documents and printed materials related to the subject, and of publications of educational organizations particularly those associated with higher education. For purposes of enrollment projections, an analysis and synthesis were made of data secured from United States Bureau of Census Reports, Tennessee Health Department statistics, and Middle Tennessee State College enrollment records.

Findings of the Study

The normal school movement was initiated at Rheims, in northern France, in 1685, and gradually spread to other European countries. The first privately controlled teacher-education institution in the United States was opened at

Concord, Vermont, in 1823, by the Reverend Samuel Hall. Through the efforts of James G. Carter, Horace Mann, and Charles Brooks in Massachusetts, the first tax-supported normal school was opened at Lexington, July 23, 1839. Tennessee's first effort at providing teacher-education was in 1875 by the acceptance by the Tennessee Legislature of the facilities of the University of Nashville. Due to the beneficence of George Peabody, an eastern philanthropist, the official designation of the institution became the Peabody State Normal School of the University of Nashville. By the provisions of the General Education Bill of 1909, a system of four normal schools, three for white students and one for Negroes, was provided. One normal for whites was located in each of the three grand divisions of the state. The normal for middle Tennessee was located at Murfreesboro, Tennessee.

Middle Tennessee State Normal School opened on September 10, 1911, with an enrollment of 175 students. Robert L. Jones, State Superintendent of Schools, was elected as first president. School objectives were embodied in the Academic Course of four years, designed for the training of secondary school teachers. President Jones resigned in 1922 and was succeeded by P. A. Lyon, mathematics instructor at the institution.

Because of national trends and area pressures, the normal in 1925 became the Middle Tennessee State Teachers College, a four-year institution offering a bachelor's degree. The depression and internal trouble greatly disrupted activities at the college from 1930 to 1938. Q. M. Smith succeeded P. A. Lyon as president in 1938.

In 1943, the transition to a multiple-purpose college was effected with the official name designation of Middle Tennessee State College. New curricular offerings included pre-professional programs, aviation, military science, business education, and a master's degree program.

Enrollment projections estimate that the 1956 enrollments of 2,076 will increase to 2,300 by 1960; 3,200 by 1965; and 4,200 by 1970. This portends an approximate 100 per cent increase in faculty, seven new dormitories, additional teaching space, expanded field services, and additions and revisions in administrative personnel.

Recommendations

Recommendations for the immediate future include:

1. A program to effect a closer relationship between the college faculty and the training school.
2. A full-time publicity or public relations agent.
3. A program to create a closer personal and professional relationship among members of a department and among departments.
4. A plan whereby the director of field services may devote full time to this service.
5. The creation of a division of research.
6. The expansion of the present counseling services to include periodic conferences with all students.
7. A more comprehensive clarification and delineation of objectives in present and future course offerings.

482 pages. $6.15. Mic 58-4227

AN INVESTIGATION OF SPEECH EDUCATION IN TEXAS SECONDARY SCHOOLS WITH SPECIAL REFERENCE TO THE SPEECH ACTIVITIES PROGRAM

(Publication No. 25,175)

Lee Bruce Roach, Ph.D.
The University of Texas, 1957

Supervisor: Professor Dr. J. G. Umstattd

The purposes of this study were, first, to determine the status of the regularly scheduled speech education program in the public junior and senior high schools of Texas; second, to find out what was taking place in the co-curricular speech activities program in the secondary schools of Texas; third, to make a detailed evaluation of the speech education program in the light of current curriculum principles and practices. The speech education program was considered from the standpoint of speech classes, speech enrollment, speech faculty, and forensic, interpretative, and drama activities. One section was devoted to the attitudes of administrators toward certain problems in speech education. All of these data were determined in terms of size of schools and in terms of geographical location to see if either size or location had any significant bearing on various parts of the speech education program in the public schools. These findings were presented in eighty-two tables and one figure, with the interpretation and evaluation of each table immediately preceding it.

A combination of the questionnaire method and the interview method was used in gathering the data. The findings in the study were based on 87.23 per cent returns to the questions from the 1,246 junior and senior high schools in Texas.

Size was found to be a factor in the number of schools of each classification offering regularly scheduled speech classes, but geographical location was found to be of no significance. In the other sections of the study, neither size nor geographical location was found to be significant.

The composite picture of the average speech teacher in Texas secondary schools was found to be a teacher with a minor in speech, teaching two speech classes and three English classes in a school of 350 enrollments. The teacher had had a minimum of training in conducting co-curricular activities, and was particularly weak in drama training.

The general status of speech education in Texas public secondary schools showed that some three of every four schools had some kind of speech education program. The number of students in the program was about one in five. A good deal of evidence was presented to show that oral communication was a basic tool for articulate responsible citizenship in a democracy. In this respect, the speech education potential was not being realized in Texas.

The data pointed to the need for speech education to be made a part of the entire school curriculum. The findings showed that speech teachers needed experience in a wide range of curricular and co-curricular speech activities. Suggestions for improving the speech education program were given, using the data as supports.

352 pages. $4.50. Mic 58-4228

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

A STUDY OF THE IN-SERVICE EDUCATION OF PUBLIC SECONDARY SCHOOL TEACHERS IN MANILA, PHILIPPINES

(Publication No. 24,838)

Alicia A. Santiago, Ed.D.
Indiana University, 1957

Chairman: Dr. Arthur Hoppe

Purpose

The purpose of this investigation was to make a study of what the public secondary school teachers in Manila were doing for professional improvement.

Method of Research

The normative-survey method of research was used in this study. A questionnaire form was filled out by 1,105 teachers.

Conclusions

The following conclusions were drawn with respect to the findings of the study:

1. Various in-service activities generally recognized by authorities in the field of in-service education as having the most effective results were found to have been offered to the teachers by their schools. Most of these activities, however, were offered on a limited basis.
2. The extent of offering of in-service activities by the school determined largely the extent of the teachers' participation in these activities.
3. Several different techniques were utilized in the faculty meetings of the schools. However, techniques which involved cooperative action were rarely utilized.
4. The relatively extensive participation of teachers in faculty meetings and group conferences with supervisors was to a great degree required rather than voluntary participation.
5. Curriculum development appeared to have been a part of the teachers' in-service education, but the techniques that were utilized left much to be desired with respect to cooperative work among themselves.
6. The supervisory staff had a vital role in providing leadership for initiating in-service activities.
7. The teachers, with few exceptions, felt that they were not offered enough external incentives to encourage them to grow professionally.
8. Evaluation of teaching tended toward the use of cooperative methods which include the teachers whose teaching was being evaluated.
9. Evidence tended to show the importance of providing professional library facilities to the teachers.
10. Workshops and conventions or conferences, when offered, were fairly well participated in by the teachers.
11. The leadership of the Bureau of Public Schools in providing in-service activities to the teachers outside of their schools was found to be important.
12. Except for professional reading of books and membership in professional organizations, female teachers were either equal to or greater than male teachers in the degree of their participation in the various in-service activities inside and outside of their schools.
13. Teachers with one year of teaching experience were found to have participated least in almost all of the various in-service activities offered to them.
14. Marital status did not seem to be an identifying factor in the teachers' participation in in-service activities.
15. Although a majority of the teachers were of the opinion that a master's degree for high school teaching was important, there was a general feeling on the part of the teachers that the holding of this degree was not the final step in a teacher's professional growth.
16. More teachers believed in periodic additional training than in the holding of a master's degree as the ultimate qualifications for high school teaching.
17. Length of teaching experience was an identifying factor with respect to the teachers' opinions about frequency of additional training.
18. It was evidently recognized by most of the teachers that professional improvement was an integral part of their job.
19. The teachers' ratings of the various in-service activities included in this study were fairly high.
20. The showing of educational films to illustrate new methods in teaching was the most highly rated curriculum revision technique by the teachers but the least utilized technique in the program.
21. The lack of instructional materials and students' second-language difficulty were the most apparent problems among the teachers in general.

379 pages. $4.85. Mic 58-4229

THE STATUS OF IN-SERVICE TEACHER EDUCATION IN THE PUBLIC SENIOR HIGH SCHOOLS OF THE STATE OF INDIANA

(Publication No. 24,839)

Bob Leslie Taylor, Ed.D.
Indiana University, 1957

Chairman: Shirley H. Engle

The problem of this thesis was to determine the status of in-service teacher education in the public senior high schools of the State of Indiana as appraised in terms of a group of selected techniques. The survey approach, using questionnaires, was employed to collect data pertaining to the problem of the study. A population of 712 public senior high schools was established by reviewing the records in the Office of the Indiana State Superintendent of Public Instruction, and a stratified, proportional, random sample of 100 high schools was drawn from the population of 712 schools. The questionnaires, developed for use in the study, were based on a list of promising practices for in-service teacher education enumerated in the conclusions of Clarence Weber's thesis, Techniques Employed in a Selected Group of Secondary Schools for Educating Teachers in Service. Questionnaires were sent to the principals of the 100 Indiana high schools in the sample, and the principals' returns were ranked according to the frequency with which they reported using the 80 techniques presented in the questionnaires. A sample of 50 teachers from the 10 lowest-ranking schools and a sample of 50 teachers from the 10 highest-ranking schools were each sent a

teachers' form of the same questionnaire, and the teachers' returns were used to validate the principals' returns. Based on the sampling procedure, the high percentage of principals' returns (98 per cent), and the validation of the principals' returns by the teachers' returns, the claim was made that the sample represented the population.

The findings of this study indicated that the following major conclusions were true with respect to the status of in-service teacher education in Indiana: (1) Teachers took an active part in faculty meetings, but they did not plan them. (2) Teachers took an active part in curriculum development activities, but they usually worked as individuals instead of in cooperative groups. (3) The most widely used techniques of in-service teacher education were related to teacher welfare. (4) In most cases the teachers were treated as employees rather than as professional people. (5) The larger schools located in the larger, wealthier cities of the northern part of the state were employing the greatest number of the selected techniques. (6) The teachers of Indiana had an excessive work load. (7) A discernible trend of in-service teacher education in Indiana was toward improving the professional competency of teachers. (8) Both principals and teachers showed a strong interest in in-service teacher education. (9) Principals and teachers were in close agreement with respect to the status of in-service teacher education in Indiana. (10) There was a wide variation among the schools as to the extent to which the selected techniques of in-service teacher education were used. (11) The emphasis of in-service teacher education in Indiana was on the well-being of the individual teacher rather than the improvement of the professional competency of teachers. (12) The status of in-service teacher education in Indiana was similar to that reported in other states. (13) A wide variety of in-service teacher education techniques was used in Indiana. (14) Lay cooperation in curriculum development was not being used. 301 pages. $3.90. Mic 58-4230

THE PROFESSION OF EDUCATION

(Publication No. 25,360)

Julius Alden Vanderpool, Ed.D.
Stanford University, 1957

The Problem

The present study grew out of an established need[1] for the practitioners in education to fulfill more adequately their responsibilities as members of a profession. It was directed toward solution of this problem of inadequate professionalization.

An assumption was that adequate professionalization will require provision in the program of preparation for a graduate course incorporating realistic experiences designed to prepare the practitioner for his role as a Member of the Profession.[2] Examination failed to reveal systematic and comprehensive literature conveniently available for use in such a course. This study was designed to prepare a syllabus to make possible the empirical testing in the field of the following hypothesis:

> The structured experiences in a course built on the syllabus resulting from this study will enable the educational practitioner to assume more adequately his responsibilities as a member of the profession.

The Method of the Study

The study was designed as follows:

1. Defining the responsibilities of a professional practitioner in education that fall outside individual duties. Highly suggestive was the work of Kinney and Thomas who identified the responsibilities common to all the professions.[3] From their statement of responsibilities and from the statement prepared from this source by Smith[4] certain responsibilities were selected as objectives. Some responsibilities were not selected as objectives for this course because other agencies had accepted them or because they were being provided for in programs of preparation.
2. Identifying the attitudes, understandings, and competences required of the practitioner which can be developed through a course designed for the purpose. These were drawn from three sources: the work of the California Council on Teacher Education as reported in Teacher Competence: Its Nature and Scope;[5] the report of the Workshop Series at Stanford University on Programs and Problems in Teacher Education;[6] and the reports by graduate students in three seminars in the Stanford School of Education.
3. Identifying appropriate experiences and organizing them into suitable units. Following the guide-lines that were formulated in conjunction with the Workshop Series and the seminars, the literature was searched for suggestions regarding suitable activities. Organization of topics was on the basis of empirical results in the seminars and emphases in the literature.

Results

A one-hundred page, logically coherent syllabus were produced which consists of three Parts of three topics each. The questions of professional status occupy Part One, professional standards are treated in Part Two, while program development in teacher education is dealt with in Part Three. An Instructor's Guide contains suggestions for additional activities and source materials as well as a guide for empirical evaluation.

Extensive empirical testing remains to be done, but in preliminary testing, improved understandings, attitudes, and competences, and active interest were observed among the participating graduate students. The validity of inclusion or omission of each responsibility as a desired outcome should be tested. That they represent socially desirable outcomes should be reviewed by philosophical societies. Experience supports the usefulness of procedures selected on the basis of logical relation to the desired outcomes, but they also need additional experimental validation.

It is important to note that revision of the objectives may be necessary. Study of their desirability, social necessity, acceptability by the practitioners, and feasibility of the practitioners' becoming competent may reveal needed revisions. 236 pages. $3.05. Mic 58-4231

1. R. A. Smith, "Maturity of Education As a Profession," unpublished Ed.D. dissertation, Stanford University, 1956.

2. California Teachers Association, Commission on Teacher Education, Teacher Competence: Its Nature and Scope (San Francisco: The Association, 1957), pp. 40-41.

3. L. B. Kinney and L. G. Thomas, Toward Professional Maturity in Education (San Francisco: California Teachers Association, 1955), p. 9.

4. Smith, op. cit., p. 58.

5. California Teachers Association, Commission on Teacher Education, op. cit.

6. California Teachers Association, Programs and Problems in Teacher Education (San Francisco: The Association, 1955), mimeographed.

A PROGRAM OF PROFESSIONAL PREPARATION FOR TEACHERS OF PHYSICAL EDUCATION WITH SPECIAL REFERENCE TO NEEDS OF YOUTH

(Publication No. 24,195)

LeRoy T. Walker, Ph.D.
New York University, 1957

Chairman: Associate Professor Roscoe Brown

It is the purpose of this study to establish a program of professional preparation based upon fuctional needs of youth of North Carolina.

The sub-problems involved in this study were:

1. What are the functional needs of youth of North Carolina?
2. What are the educational and physical education experiences required to satisfy the needs identified?
3. What are the leadership competencies necessary to provide these experiences?
4. What is the present level of competency of teachers presently providing the experiences on the secondary level?
5. What is the program of professional preparation which would better prepare prospective teachers to more effectively provide educational experiences in North Carolina?

Procedures

Four types of information were necessary for this study:

1. Opinions of specialists on the tasks, needs, experiences, and competencies.
2. Information on programs of professional preparation in colleges of North Carolina and those recommended by specialists.
3. Opinions of panelists on professional competency of teachers.
4. Opinions of specialists on the nature of the curriculum.

Information for the above types was obtained from current professional literature, related studies and expert opinion; from departmental schedules obtained from physical education directors, from college catalogs and studies of T. Erwim Blesh, Charles Bucher and Charles H. Hart; from a check list, respectively.

Summary and Findings

The findings are necessarily limited to the sample studied and the method of evaluation used, and may not therefore, reflect the quality of preparation of all prospective and experienced teachers of North Carolina. The findings are listed below.

1. Four broad developmental tasks were prominently mentioned: social, emotional, physical and intellectual.
2. Needs created in these tasks grow out of adjustments to four persistent life problems: individual health and development, civic living, social living, and vocational choice, preparation and success.
3. The mean ratings of 3.0, 3.0, 3.2 and 3.2 for individual health, civic living, social living and vocational choice, respectively, indicate only average ability of groups to discharge duties in these areas.
4. Seven teachers obtained superior ratings in one or more categories.
5. Intercorrelations of panels' ratings of teachers and teachers' ratings of quality of academic preparation yielded coefficients of .111 for individual health, .407 for civic living, .468 for social living and .590 for vocational choice. None indicated a marked trend for high panelists ratings to accompany high teacher ratings.
6. 127 semester hours of the four year curriculum allotted as follows: 53 to general education, 27 to educational theory and practice and 47 to specialized education.
7. The courses were allocated as follows:

   1st year - courses to give teachers understanding of himself, his new cultural heritage, the art of communication, the aesthetic and the world of nature.

   2nd year - courses which give understanding about growth and development of youth, problems of health and foundations of education.

   3rd year - Continuation of the initial training and preparation to work within the school structure.

   4th year - courses to develop: breadth, integration, a set of operational principles and techniques of evaluation.

8. New innovations especially designed to meet the needs were:
   1. establishing skill blocks, combining skills and methods, providing remedial skills and including more physical skills in freshman year.
   2. organizing courses into communications block, science block, sociology block.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

3. assigning student teaching experiences on a one-half year rotation basis.
4. establishing new courses; community orientation, evaluation, professional seminar, and supervision and practice.

Implications for Further Study

When it becomes evident that needs of students are not being adequately met by the existing curriculum there must be some way to utilize new knowledge from evaluation in meeting newly discovered needs. The critical incidence technique and direct observation of teachers to detect the characteristics of the teachers' methods which seem to produce the desired changes in behavior may be employed in future research on this type problem.

329 pages. $4.25. Mic 57-4232

PRE-SERVICE BUSINESS TEACHER EDUCATION IN CALIFORNIA

(Publication No. 25,309)

William Leonal Winnett, Ed.D.
University of Illinois, 1957

The purpose of this study was to determine the commendable unique factors in pre-service business teacher education in California. The complete program from recruitment through follow-up was studied. The study was designed to answer the questions: (1) What was the California plan for the certification of business teachers? (2) What were the practices in each of the several areas of business teacher education in California? (3) Which of the above practices were both commendable and unique? Only those factors which were approved by the accrediting standards of the American Association of Colleges for Teacher Education were accepted as commendable. To be classified as unique, the practice had to stand out and be found in only small fraction of business teacher education programs in the nation.

A set of Principles of Business Teacher Education was derived from the accrediting standards. The Business Education Supplement to the Evaluation Schedules of the American Association of Colleges for Teacher Education was used as a guide in constructing a master data sheet, one copy of which was prepared for each of the nine state college and four university programs included in the study. The primary method of collecting the data was by interview schedule. On each campus, interviews were held with the faculty members who were most directly concerned with the education of business teachers.

Practices in the thirteen institutions were classified and tabulated under one of four categories: administration, including organization, objectives, and library; student personnel services, including recruitment, admission and selection, orientation and guidance, and placement and follow-up; curriculum, including general education, business subjects, business experience, professional teacher education, and total requirements; and professional laboratory experiences, including pre-student teaching, student teaching, and post-student teaching. The findings were reported according to total practices in the state colleges, total practices in the universities, and the thirty-two commendable unique factors identified in the study.

The principles derived from the accrediting standards were used to determine the commendable qualities of each factor. The commendable factors were submitted to a test for uniqueness. Research findings, opinions of authorities expressed in professional literature, and the investigator's judgment were used as criteria for uniqueness.

For illustrative purposes, the following were selected from among the thirty-two commendable unique factors:

A statement of characteristics to be developed by business teachers had been formulated.

An assessment of local business teacher needs was reconciled with the capacity of the program facilities to establish a specific number as a guide in the recruitment and selection of business teacher candidates.

Career meetings, including a teacher's convocation, were held at the beginning of each semester.

A general education program was constructed on the basis of an educated person's personal, social, and civic functions and by the development of courses and course contents to serve these functions.

The foundation work in professional education was organized in a block of integrated study and activities.

Participation in a supervised work-experience program was required of all business teaching majors.

Student teachers were assigned a major non-classroom responsibility.

A study of consumer economics was required in the pre-service program of all business teaching majors.

The study of guidance was required of business teacher candidates.

Remuneration for the supervising services of master teachers was paid to the school rather than to the teacher. 194 pages. $2.55. Mic 58-4233

VALUES OF THE YOUNG CHARACTERS IN THE FICTION OF DOS PASSOS, HEMINGWAY, AND STEINBECK

(Publication No. 25,401)

Leo Vernon Young, Ph.D.
Stanford University, 1957

The English Language Arts instructor who teaches American literature is expected to help transmit values prized in our culture. In this study, the fiction of John Dos Passos, Ernest Hemingway, and John Steinbeck are analyzed to determine the values and the sources of values important in the lives of their youthful characters. These values and sources are compared to those reported by the sociologists as existing in American society and to those listed by the Educational Policies Commission (EPC) of the National Education Association and the American Association of School Administrators in Moral and Spiritual Values in the Public Schools.

Education for moral and spiritual values has been a

concern of American schools since their inception. From "Ye Ould Deluder, Satan" Act of 1647, which laid the foundation of the American free school system, to the present time, educators have revised the value systems which the schools ought to teach, but basic to these revisions have been the traditions of our Judeo-Christian inheritance and the tenets of American democracy. One of the important contemporary statements on this subject is the EPC's Moral and Spiritual Values, published in 1951.

The EPC lists four major sources of moral and spiritual values: the home, the school, the church, and the community. A list of ten values, consisting of those upon which the "American people are agreed," is given, but the Commission does not claim the list to be complete or final. To examine the validity of the EPC's values, some sociological studies are reviewed to present the moral values and their sources that the social scientists see in society today.

The sociologists agree that there are social classes in American society. Material prosperity seems to be the crucial source of value in American society, but this has different manifestations in the social class systems. The sociological studies were also used for information about the sources of values of youngsters.

Dos Passos' fiction reveals that he portrays the family as the origin of values, but these can be negative or positive, depending upon the kind of parental love the child experiences. The concept of community does not emerge in his fiction; he dramatizes society as an important influence on his youthful characters, but the influence of a particular segment of society is harmful. School and church fail as sources of moral and spiritual values. Books and nature, however, are important sources.

In Hemingway's fiction, society is a constant threat to the youngsters. The father, not the family, is a chief source of values; and nature is the strongest.

Steinbeck's fiction reveals that he sees the family as a locus of values, but both the school and the community--when under the domination of teleological characters--harm, rather than help, children. Religion, not church, exists in his fiction, but this religion blends with the most important source of values for his young characters--nature.

The English instructor need have little apprehension that the fiction of the three authors is contrary to the basic premises of democracy, although the values held by the young characters may often seem different from those held by some members of our middle class. These youngsters can accept books as real experience. Thus, the contributions of the instructor to students' moral and spiritual values may be crucial. Because these three important novelists see nature as a prime source of moral and spiritual values, instructors should be aware of this influence.

248 pages. $3.20. Mic 58-4234

EDUCATION, THEORY AND PRACTICE

A COMPARISON OF THE EFFECTIVENESS OF TWO TEACHING TECHNIQUES ON THE ABILITY OF COLLEGE STUDENTS TO APPLY PRINCIPLES OF PHYSICS TO NEW TECHNICAL PROBLEMS

(Publication No. 24,967)

George Alterman, Ph.D.
New York University, 1957

Chairman: J. Darrell Barnard

The major purpose of this study was to determine the comparative effectiveness of two methods of presenting physics principles on the ability of college students to apply principles of physics to new situations.

The method designated as the control consisted essentially of starting with a statement of a principle and then proceeding to illustrate and apply this principle. The experimental method attempted to develop principles by demonstration and analysis of applications or situations before the principle was stated or formalized. It was hypothesized that this latter or experimental approach would lead to a better understanding of the principles and therefore, to better results on a test of the ability of students to apply principles to new situations. It was further hypothesized that the ability to apply principles in physics is different from the ability to recall facts in physics, but is highly correlated with the ability to solve mathematical or formula type problems in physics.

Both the control and experimental groups were given four preliminary tests, namely the A.C.E. Psychological Test, the Watson-Glaser Critical Thinking Appraisal, the Dunning Physics Test, and the Snader General Mathematics Test. An analysis of the difference between the means (t-test) showed no significant differences between the groups on these preliminary tests.

At the end of one semester of physics, each group was given three tests constructed by the investigator. These tests were: a) a test of recall of facts in physics; b) a test of ability to solve mathematical or formula type problems in physics; and c) a test of application of principles of physics to new situations. The investigator calculated coefficients of correlation between preliminary and final tests as well as between each of the final tests. A t-test of significance of the difference between the means of the control and experimental groups was determined for each final test. In addition, the groups were sub-divided into three levels for each of the preliminary tests and a t-test of significance of the difference between groups was obtained for each level.

The results of the statistical analysis of the data indicated that:

1. The experimental method produced significantly better results than the control method only with students rating low on preliminary background tests, and then solely in the area of application of principles to new situations.
2. The ability of students to recall facts and principles of physics is highly correlated with the ability to apply principles to new situations as well as with the ability to solve mathematical or formula type problems in physics.

3. The ability to solve formula or mathematical type problems in physics is significantly but not highly correlated with the ability to apply principles to new situations. 80 pages. $2.00. Mic 58-4235

THE CRITICAL INCIDENT TECHNIQUE AS AN INSTRUMENT OF EDUCATIONAL RESEARCH: A PHILOSOPHICAL ANALYSIS

(Publication No. 25,345)

Hobert Warren Burns, Ed.D.
Stanford University, 1957

1. Statement of the Problem

The critical incident technique is

> . . . a procedure for gathering certain important facts concerning behavior [such that the] critical incident technique . . . will provide a stable foundation for procedures in many areas of psychology.[1]

The rationale of the dissertation was that any procedure which aspires to provide psychology, and thereby education, with such a method is deserving of a close conceptual analysis. The problem was one of instrumental value: of what use is the critical incident technique, as an instrument of science, in educational research?

This general problem of the dissertation entailed the following specific problems:

1. What is the status of the critical incident technique as an instrument of science?
2. What are the necessary presuppositions which underly the critical incident technique?
3. What is the defensible role of the critical incident technique in studies which attempt to identify perceptions?
4. What is the defensible role of the critical incident technique in studies which attempt to conduct educational job-analyses?
5. What is the defensible role of the critical incident technique in studies which attempt to ascertain educational success-criteria?

2. Procedures of the Dissertation

To analyze the technique six criteria of empirical science were developed. Following this, the five steps of the technique were analyzed to determine whether the technique was consistent with the criteria. The necessary presuppositions of the technique were also identified and examined. After the analysis of the technique was completed, specific problem-areas were analyzed. On the basis of these analyses--the technique as a scientific instrument, and the problem-areas in which the technique had been utilized--results and conclusions were reached.

3. Results of the Dissertation

The critical incident technique as originally formulated did not entirely meet the requirements of an instrument of science. Several suggestions for revisions in the technique were made, the most important of which were:

Step One, "The General Aim," was revised to become "The Specific Aim(s)." This revision provides more direction for the process of inquiry.

Step Two, "The Plans for Observation," was revised to provide for a rigidly defined frame-of-reference; this was possible through the specification of aims in the previous step.

Step Three, "The Collection of Data," was consistent with the criteria.

Step Four, "The Analysis of Data," was supplemented by a provision for the objective induction of categories from the basic data.

Step Five, "The Interpretation and Reporting of the Data," was supplemented by procedures which would permit data to be interpreted specifically and generally, and to report findings in existential or qualified-universal propositions.

With the incorporation of the suggestions, the technique can meet the criteria and can be used as an instrument of science in educational research. Once the potential validity of the technique was established, specific usages of it were analyzed with these results:

First, the technique can be used to (1) identify [reports of] perceptions, (2) identify and compare perceptions, and (3) identify, compare, and verify perceptions.

Second, the technique can be used in job-analyses if the criteria of job-success are incorporated in "The Specific Aim(s)" and the frames-of-reference of the analyses.

Third, the problem of success-criteria is not a task of discovery or revelation, but one of creation and hypothecation. The use of the technique to ascertain success-criteria is a problem of scientific investigation into values. The technique can be employed in scientific investigation of values, and it can be used to help create and verify hypotheses about educational success-criteria.

4. Conclusions of the Dissertation

The critical incident technique, with revision, can meet the criteria and become an appropriate instrument of science for use in the scientific solution of many scientific and practical problems of education.

413 pages. $5.30. Mic 58-4236

1. John C. Flanagan, "The Critical Incident Technique," Psychological Bulletin, 51:4, 1954. Pp. 335, 355.

THE DEVELOPMENT OF A SELF-INSTRUCTING MANUAL FOR THE BURROUGHS SENSIMATIC F 100

(Publication No. 24,186)

Nicholas J. Cornelia, Ed.D.
New York University, 1957

This study deals with the qualifications, duties, and production standards of Burroughs Sensimatic F 100 Bookkeeping Machine Operators and the collection of information on the kinds of records compiled on such machines as well as the machine bookkeeping operational patterns used by experienced operators.

The operational manuals of five bookkeeping machine manufacturers are analyzed to determine which transactions, machine bookkeeping patterns, and instructional devices are used to train operators in their training centers.

Selected sections of five bookkeeping textbooks are

analyzed to obtain data on the kinds of transactions, number of problems, and kinds of visual aids used in presenting posting procedures for customers' accounts, creditors' accounts, and the compiling of payroll journals and related records.

Observations made on fifty-three office visitations are studied to list the kinds of records compiled on bookkeeping machines, the exact procedures followed in operating the machines, the posting media used, the duties of operators related to machine posting, the duties of operators not related to machine posting, and the accuracy and speed standards of machine posting.

Personal interviews with employers and/or personnel managers are used to determine the employment policies followed by those who hire bookkeeping machine operators and to list their recommendations for the improvement of machine bookkeeping training.

Data obtained from personal interviews with selected bookkeeping machine operators are analyzed to obtain information on the amount of general education, machine posting training, machine posting experience of employed operators, and their recommendations for the improvement of the training of machine bookkeepers.

The study reveals:

1. That 77.3 per cent of the operators interviewed were trained on the job
2. That the median training period of an operator was one week
3. That 68 per cent of the employers interviewed hire beginners or up-grade promising clerks whom they train themselves
4. That only 18.9 per cent of the offices visited had enough machine posting to assign employees exclusively to machine bookkeeping
5. That the posting media used for machine posting consists of both handwritten and typewritten business papers or books of original entry
6. That to qualify as a fully trained bookkeeping machine operator for 86.79 per cent of the businesses visited in this study, an operator had to be able to post to customers' accounts, creditors' accounts, general ledger accounts, and to prepare payrolls and related records
7. That 71 per cent of the bookkeeping machine operators and 20 per cent of the employers interviewed mentioned instruction in the theory and practice of manual bookkeeping as a means of improving the training of bookkeeping machine operators
8. That the speed of posting ranged from a low of 253 postings per day to a high of 737 postings

The conclusion drawn is that an operational manual for the training of bookkeeping machine operators should have posting assignments affecting customers' accounts, creditors' accounts, general ledger accounts, and the preparation of payrolls and related records. These assignments should contain: step-by-step operational instructions on the posting patterns used in each assignment, a detailed description of the business situation out of which the posting assignment originated, summaries of the business procedures and principles covered in each unit, and tests in both the theory and practice of machine posting.

216 pages. $2.80. Mic 58-4237

DEVELOPING SCIENTIFIC ATTITUDES BY RESPONDING ACTIVELY TO MOTION PICTURES: A STUDY TO DETERMINE IF RESPONDING ACTIVELY TO SELECTED MOTION PICTURES BY IDENTIFYING THE PROBLEM-SOLVING SKILLS THEY PORTRAY REINFORCES OR DEVELOPS A SCIENTIFIC ATTITUDE IN COLLEGE FRESHMEN

(Publication No. 24,977)

Nicholas D. De Prospo, Ph.D.
New York University, 1957

Chairman: Dr. Elwood J. Winters

In the past thirty years, educational leaders have continually called attention to the need and importance of emphasizing desirable attitudes in teaching procedures. A review of the literature with respect to the objectives of science instruction substantiates this fact. Likewise the literature reveals that science teachers disagree as to the way that this objective can best be developed in students. This condition indicates the need for studies concerned with the effectiveness of methods for the teaching of the scientific attitudes.

This study was undertaken to determine if responding actively to selected motion picture by identifying the problem-solving skills they portray reinforces or develops the scientific attitude of "suspended judgment" in college freshmen.

The students enrolled in General Biology I and General Science I at Seton Hall University, 240 in all, constituted the population for the investigation. They were randomly divided into three sections: an Experimental Group (X), a Film Control Group (FC), and a No Film Control Group (NFC).

To determine whether or not the samples were representative of the population, the means, standard deviations and population variances were compared on four variables: Scholastic aptitude, science preference, opinion of the scientists portrayed, and the attitude of "suspended judgment."

A preliminary survey of catalogues and other sources led to the choice of ten films. A detailed analysis of the number of scenes devoted to problem-solving resulted in the final selection of "Madame Curie" and "Yellow Jack." A reanalysis demonstrated the reliability of the investigator's judgment and validity came from agreement with a panel of three judges.

After the panel had unanimously approved, the film, "The Scientific Method," was selected to introduce the problem-solving skills to the subjects of the experiment.

In constructing the Scale of Suspended Judgment, fifty-five statements of opinion were culled from various sources. Upon the Panel's advice only forty-six items were retained. These were sent to 85 well trained science educators to be rated from 1 to 9 for use in a Thurstone-type scale. Out of forty-five replies, forty were kept for

final statistical treatment. A test for ambiguity resulted in a final form of twenty items having an index of reliability of .88

The experiment covered three consecutive periods, during which time, the NFC Group continued its routine class work and the FC Group just viewed the three films. However, the X Group was made aware of the object of the experiment and recieved some prior motivation. It "participated" by identifying the problem-solving skills as they were portrayed and by answering specific questions concerning them after viewing the films.

The criterion for achievement was the change in attitude at the end of the experiment. Thus a "within group" comparison of the differences in the means and standard deviations between the initial and final attitude scores was made. Similar statistical techniques and the test for homogeneity of variance were applied to the second set of scores to determine "between group" differences.

A third administration of the scale six weeks after the experiment was used to test retention. Relationships between the gain in attitudes and certain factors considered were determined by simple and partial r's.

It was concluded that: (1) the X and FC Groups showed a significant gain in attitude, whereas that of the NFC Group was negligible, (2) The differences between the X and FC Group were not significant, (3) The change in attitude was not related to scholastic aptitude or to the ability to identify the problem-solving skills, (4) The change in attitude had a moderate negative relationship to the opinion of the scientists portrayed, (5) The net correlation of the gain in attitude with science preference is slight, being positive for the X Group and negative for the FC Group, and (6) The contribution of the films was not as great to retention as to the gain in attitude.

This investigation has provided a first indication that films can be used to effectively develop scientific attitudes at the college level. It also has supplied further evidence that scientific attitudes can be taught directly and that they are concomitants of the scientific method.

160 pages. $2.10. Mic 58-4238

THE EXTENT OF THE RELATIONSHIP BETWEEN THEORY AND PRACTICE IN THE TEACHING OF SOCIAL STUDIES IN THE ELEMENTARY SCHOOL

(Publication No. 25,329)

Charles Maurice DeWitt, Ed.D.
University of Maryland, 1957

Supervisor: Dr. Leo W. O'Neill, Jr.

This study was based on the hypothesis that a large amount of lag exists between theory and practice in the teaching of the social studies in the elementary school. The problem was to determine the extent of the lag, the particular areas experiencing lag, and proper theory for the social studies as determined by the opinion of experts. A secondary problem was to determine the relationship of the factors of school size, education of the principal, experience of the principal, size of the school district, type of school organization, and geographical region to social studies instruction.

The purpose of the study was to secure some data so that principles could be formulated and recommendations made which would contribute to the teaching of social studies. Three questionnaires were developed which included major problems and issues in the social studies. The questionnaires were concerned with three major areas --methods of teaching, objectives, and the organization of social studies content.

A carefully selected panel consisting of experts in the field was divided into three groups and each sent a questionnaire dealing with a major area of the study. The questions were designed to elicit responses in terms of what the experts thought were the most desirable practices. A large group of elementary school principals, selected by random sampling procedures, was divided into three groups and each sent a questionnaire pertaining to one of the major areas. The questions to the principals were worded in such a way that current practice could be determined from the responses.

The accuracy of the responses of principals was verified by comparing the responses of a sample of the principals with responses of social studies teachers in the same schools.

Returns were shown in tables using percentage figures. The chi-square statistic was used to show relationship. The .05 level was used throughout the study to test for significance. An analysis was made of the responses of experts and administrators to each item of every question and the distribution of responses of administrators to the six factors.

Specific findings were listed showing the important and significant differences between responses of experts and administrators to certain items, and those showing relationships of the six factors to social studies instruction.

Sufficient evidence was found to support the hypothesis that a large amount of lag exists between theory and practice in the teaching of the social studies in the elementary school. In many areas the lag is of sufficient proportion to be described as serious. The least amount of lag exists in the area of the organization of content. Generally, there is not a large amount of lag in regards to the objectives for the social studies, however, some very serious questions center about problems in this area. It is in the area of method that theory is the farthest behind practice.

None of the six factors was found to be highly related to social studies instruction. The most important of the factors were size of district, education of principal, and geographical region. The least important factor was the experience of the principal.

Approximately twenty definite recommendations were made which were based upon the findings. It is believed that the implementation of these recommendations would do a great deal to improve the social studies instruction in the elementary school. 301 pages. $3.90. Mic 58-4239

THE EFFECTS OF A FAST-LEARNER PROGRAM ON THE SOCIAL RELATIONSHIPS OF ELEMENTARY SCHOOL CHILDREN

(Publication No. 25,350)

Mary Nicholson Goldworth, Ed.D.
Stanford University, 1957

This study attempts to determine the effects of an elementary school fast-learner program, involving part-time special class grouping, on the school relationships of children within the regular classroom setting. Special classes for fast-learners were provided twice a week for periods of an-hour-and-a-half. Fast learners were selected on the basis of 130 IQ and above on the California Test of Mental Maturity or 120 IQ and above on the short form of the Stanford-Binet. Regular classrooms of the fourth through eighth grades were divided into experimental and control groups which were quivalent in size, IQ distribution, sociometric status, and number of fast-learners. Fast-learners in the experimental group attended the special classes whereas those in the control group did not. The Columbia Classroom Social Distance Scale and the Sociometric Test were administered to all children before and after the fast-learner program was in effect. Differences between experimental and control groups were tested for significance with respect to changes which took place regarding the following five variables. Findings are reported in each case.

1. Children's acceptance of each other as friends. Social Distance Scale data were utilized for this section as well as for parts 2 and 3 below. At all grade levels it was found that the proportion of children showing an increase in the degree to which they were accepted as friends by their classmates was significantly greater ($P < .001$) for control children than for experimental children. (This findings is modified by the data in part 4.)

2. Children's acceptance of fast-learners as friends. In grades 4-5, it was found that the proportion of fast-learners showing an increase in the degree to which they were accepted as friends by their classmates was greater in the control group than in the experimental group. The difference was not significant ($.10 > P > .05$) but warrants attention since it is in the same direction as that found in the previous instance. In grades 7-8, the difference between fast-learners in the control group and those in the experimental group was not significant ($.80 > P > .70$).

3. Fast-learner's acceptance of classmates as friends. In comparing fast-learners in the experimental group and fast-learners in the control group with respect to change in the degree to which they accepted their classmates as friends, it was found that, at all grade levels, differences were not significant ($.50 > P > .30$).

4. Degree of cohesion within regular classroom groups. Sociometric Test data were utilized for this section as well as for part 5. These data involved three criteria which referred to children's preferences as to which classmates they would most like to "work-with," "play-with," and "sit-with." Comparison of classrooms in the experimental group and classrooms in the control group with respect to the degree of change in group cohesion indicated that, with one exception, there were no significant differences at any grade level or for any of the three sociometric test criteria. (Probabilities ranged from $.50 > P > .30$ to $.99 > P > .98$). These results seem to modify the findings for question one.

5. Degree of fast-learner sub-group preference within regular classroom groups. This question was concerned with the extent to which fast-learners who attended special classes might have formed sub-groups or cliques. Comparison of classrooms in the experimental group and classrooms in the control group for all of the grade levels and for each of the three criteria indicated no significant differences. (Probabilities ranged from $.50 > P > .30$ to $.99 > P > .98$).

It was concluded that, despite the occurrence of some changes which might be termed negative, children's social relationships, as defined herein, remained stable to a considerable degree. 141 pages. $2.00. Mic 58-4240

AN ANALYSIS OF SELECTED INFLUENTIAL CONCEPTS OF EXPERIENCE AND THEIR BEARING UPON A THEORY OF EDUCATION

(Publication No. 25,222)

George Vance Guy, Ph.D.
University of Illinois, 1957

The study is an investigation into concepts of experience which have played a prominent role in modern education. An introductory chapter suggests the prominence of the term in common sense and briefly explores the hypothesis that its use is often confused and ambiguous in meaning. Moreover, it documents the emerging prevalence of the term in education and indicates the need for adequate theoretical foundations if the term is to have valid meaning and to escape confusion and ambiguity in its educational context.

Following the establishment of a connection between John Dewey and the project method, the activity and experience curricula, the study is delimited to a discussion of the concepts of experience of Dewey, Kilpatrick, Mossman, and Hopkins -- the first as a basis for evaluating the adequacy of the concepts of the latter three figures, selected to represent respectively the educational movements noted above and, thereby, to determine the extent to which these educational movements have adhered to the thought of Dewey and from which they largely have recieved their theoretical justification.

The four selected concepts are discussed both substantively and in terms of a four-dimensional analysis of the experience knowledge relationship, involving the dimensions of temporal sequence, alstraction, the process of verification, and the context of operational definition.

Principal findings indicate, first, a neglect of the vital role of perceptual judgment -- the awareness of relationships -- as the qualitative element in Dewey's concept of experience. Secondly, undue concern with the psychological aspects of the experience-knowledge relationship have tended to ignore the logical and, consequently, have modified, in varying degrees, the meaning of the process of verification and, to a lesser degree, the degree of abstraction of knowledge from experience and the breadth of the context of operational definition. The first misinterpretation of Dewey has resulted in an identification of experience with behavioral activity with the concomitant implication that learning or knowledge-getting is automatic with such activity. The second has resulted in subjectivism or egocentrism in knowledge and thereby

neglected the logical constructs stemming from human experience.

Dewey's concept of experience is clarified in meaning through the introduction of and distinctions made between individual experience, on the one hand, and racial or human experience on the other. Dewey's concept is further clarified not only by considering the integral relationship between experience and knowledge, but by noting and distinguishing as well the proper relationship between private knowledge, on the one hand, and public knowledge on the other.

The implications of Dewey's concept of experience as interpreted are developed in terms of the nature of educational objectives, content, and methodology. Two appendices are included which discuss briefly conceptions of the nature of curriculum and of educational philosophy.

171 pages. $2.25. Mic 58-4241

CONTRIBUTIONS OF BUSINESS EDUCATION TO SELECTED PROBLEM AREAS OF GENERAL EDUCATION IN THE SECONDARY SCHOOL

(Publication No. 24,065)

William E. Jennings, Ph.D.
The Ohio State University, 1952

In our present increasingly complex economic social system, a more functional type of curriculum is needed to replace the traditional subject-centered one of the secondary school. Some minor changes have taken place in the subject-centered curriculum, such as adding more elective courses, providing for home-room and extra-curricular activity periods, and enlarging the curriculum to allow for more specialization on the part of students.

The changes indicate the inadequacies of the subject-centered curriculum. Other factors which give rise to a more functional curriculum are (1) the increased enrollment in the secondary school, (2) the new ideas concerning good teaching methods and the nature of the learning process, (3) the new emphasis on the meaning of democracy, and (4) the need for a curriculum to satisfy the needs of all youth.

Throughout the country attempts have been made toward achieving a more functional-type of curriculum. These attempts have taken the form of unified studies, core programs, common learnings, and greater emphasis on general education. These attempts are similar in that they seem to have the same basic philosophy and the same general plan of organization.

The number of secondary schools in which a common-learnings or core program is being emphasized is slowly but steadily increasing throughout the United States. In schools where the core program has existed as an elective, an increasing number of students elect the core each year. Certain democratic values give rise to this type of secondary program. These values are (1) respect for the worth of human personality, (2) faith in working together for the common good, and (3) faith that the use of intelligence will bring man to progressive gains in the control of his environment.

The core-type program was chosen as the basis of the study because it provides a common-learnings area for all youth, a democratic setting for individual and group experiences, and it cuts across subject-matter lines providing varied experiences needed by all youth. The subject-centered curriculum does not provide general business education for all students in the secondary school.

From the writer's point of view, some curricular structure is essential to a sound secondary school program, and pre-planning on the part of the teacher is an absolute necessity. For these reasons the study is based on Type V core, as analyzed by Alberty.[1]

The recent trend toward curriculum reorganization in terms of the core concept has caused the so-called subject-matter areas, or special fields, to consider what might be their particular contributions to general education. Since core problems cut across traditional subject-matter lines, subject-matter fields, in some instances, have rich contributions to make in the solution of common problems of youth.

In the present complex interdependent life, business touches almost every human activity. Our system of government and individual enterprise makes it imperative that our youth know how to perform the general economic transactions of everyday living. Economic literacy is basic to the democratic way of living.

In view of the need for preparing all youth to deal competently with business problems and the critical need for effecitve teaching of general business, this study of business contributions to the general education of all students was undertaken. Two purposes gave direction to it:

1. To construct suggestive activities, dealing with significant problems and issues, suitable to the teaching of general education, without regard to subject-matter boundaries

2. To develop suggestive contributions of business education to the activities dealing with general education

The construction of suggestive activities for the teaching of general education was a coöperative study made by Elsie Stalzer in mathematics education, Monir Mikhail in science education, and the writer in business education.

The sixteen problem areas as outlined by Lurry[2] were accepted as the basis for the general education or core activities. This list of problem areas seemed to be the most recent, the most valid, and the most comprehensive. The areas are Problems of School Living, Self-Understanding, Finding Values by Which We Live, Social Relationships in a Democracy, Employment and Vocations, Using and Conserving Natural Resources, Education in American Democracy, Constructive Use of Leisure, Family Living, Communication, Democratic Government, Personal and Community Health, Economic Relationships in a Democracy, Critical Thinking, Achieving World Peace in the Atomic Age, and Intercultural Relations.

As the basis for constructing the core activities the following criteria were used: Core activities should

1. Deal with significant problems and issues that have a bearing on a problem area without regard to subject-matter boundaries

2. Have potentialities for developing and promoting values basic to democratic living

3. Be sufficiently diversified to provide for individual differences among students

4. Provide the kind of experiences that are likely to contribute to the students' all-round development

5. Suggest sufficient direction for action

6. Be organized in such a way that they can most effectively be used
7. Be comprehensive rather than fragmentary in character

General business education includes the skills, knowledges, and appreciations necessary for one to participate intelligently in the economic and civic activities of present-day society. In order to define and understand general business, it is necessary to know the phases of business that are included. A number of recent studies have been made in an effort to determine the common business learnings that are needed by all youth.

The comprehensive studies of Muse,[3] Freeman,[4] and Moorman[5] fairly adequately defined the business understandings needed by all youth. These business understandings are concerned with the following eight phases of business education:

1. Finance, which includes banking services, credit, thrift, insurance, social security, business cycles, investments, taxes, and government finance
2. Record-keeping, which includes personal records, budgeting, and filing
3. Communication, which includes business correspondence, instruments of communication, and costs involved in communications
4. Distribution, which includes transportation facilities, travel services, selling goods and services, basic techniques of selling, and international trade
5. Consumer Education, which involves advertising influences, planning a spending program, standard grades and labels, shopping habits, laws that protect the consumer, legal obligations and rights, government agencies that protect consumers, and renting or leasing property
6. Organization and Management, which deals with various types of businesses, efficient organization of personal affairs, government regulation and control of business, managing a small business, various economic systems, and the determining of wages
7. Occupational Information, which includes the knowledge of skills and abilities needed in various occupations, need for long-range planning, types of business positions available, working in large and small organizations, and how to find and hold a job
8. Human Relations in Business Situations, which deals with the development of personality, sensitivity to the reactions of others, courtesy and good business manners, friendly business relations, business attitudes, and intercultural and international relations

These eight phases of general business education appear again and again in the suggested core activities. This study lists forty-two comprehensive general business understandings which seem to grow out of the suggested core activities. Each of the business understandings relates to one or more of the eight phases of general business education listed.

Major Conclusions

The following major conclusions are drawn with respect to general business education in the secondary school:

1. Business education has significant contributions to make in the general education of all secondary youth.
2. Recent studies have defined, rather precisely, the phases of business which are needed by all youth in order to live effectively and successfully in a democratic society.
3. The core activities embracing general education cut across general business education and include opportunities for student experiences in all phases of general business education.

Responsibilities of the Business Teacher in a Core Program

In a secondary school which includes a core program, whether the core is required of all students or whether it is elective, the business teacher has a dual responsibility. He is responsible not only for the vocational or special area classes, such as bookkeeping, shorthand, and typewriting, but also for making contributions of general business education to the core groups. The business teacher may contribute to the core program by engaging in the following activities:

1. Working with staff members in the pre-planning stage, suggesting content, available materials and information, trips, speakers, and movies
2. Working with core-planning groups, helping members of the group become aware of the business aspects which may be included in the various units
3. Preparing a resource file of free or inexpensive materials on general business subjects, such as banking, consumer education, communication, and occupational information
4. Cataloging business books, films, and other teaching and learning aids which pertain to general business education
5. Participating in the core groups
6. Being available to students and teachers to aid them with business problems growing out of the core activities

Recommendations

The following recommendations are made:

1. That administrative and supervisory personnel take active leadership in making provision for the inclusion of general business education, in the secondary school curriculum, so that it will be available to all youth
2. That core teachers give more study to worthy contributions which the special subject-matter teachers may have to offer in the all-round development of youth
3. That business teachers extend their teaching beyond that of the vocational subjects and accept a dual responsibility by promoting economic literacy in all students in the secondary school
4. That business teachers work more closely with the core teachers, contributing to the program by giving aid in pre-planning, by consultation, and by actual participation in the core group
5. That other studies be undertaken to explore further contributions to the general education of all secondary-school students.

560 pages. $7.10. Mic 58-4242

1. Alberty, Harold, "Developing a Curriculum That Meets the Needs of Junior High-School Youtn," Bulletin of the National Association of Secondary School Principals, XXXI (April, 1947), pp. 69-82.

2. Lurry, Lucile, "The Contribution of Home Economics to Selected Areas in the Core Curriculum of the Secondary School." Unpublished doctoral dissertation, The Ohio State University, 1949.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

3. Muse, Paul F., "A Study of the Business Activities, Interests, and Understandings of Secondary School Pupils and Adults as a Basis for Determining Subject Matter, Content, and Grade Placement of Basic Business Education in the Secondary School." Unpublished doctoral Dissertation, The Ohio State University, 1946.

4. Herbert M. Freeman, Basic Business Education for Everyday Living. Cincinnati, Ohio: South-Western Publishing Co., 1951.

5. Moorman, John H. Basic Economic Concepts. Cincinnati, Ohio: South-Western Publishing Company, 1949.

Abstract published by special arrangement with The Ohio State University.

CRITERIA FOR EVALUATING A STATE-WIDE IN-SCHOOL DISTRIBUTIVE EDUCATION PROGRAM

(Publication No. 24,071)

William Boyd Logan, Ph.D.
The Ohio State University, 1952

Our public schools are vulnerable to criticism, particularly when state and federal monies are used in their support. This situation, together with other conditions, is directing the attention of school leaders toward evaluation as a means of discovering the weak points and rectifying them before other individuals and agencies discover the deficiencies and use them as targets of criticism.

Various educational groups have developed criteria and instruments for evaluating their programs. These evaluation instruments usually consist of a statement of principles, a list of evidences with procedures for rating them, and a plan for securing an evaluation of the educational program. Many of the instruments are designed for self-evaluation, and others are designed to be used by a visiting evaluation team. These instruments have proved their worth to the school, the community, and the pupil.

There is an apparent need for an instrument to be used by the several states in evaluating distributive education programs. Therefore, the purpose of this study is to develop criteria which might be used in determining the effectiveness of a state-wide in-school distributive education program, including local programs and professional services provided by and through state departments of education, and to develop techniques and procedures for conducting the evaluations in local communities and in state departments of education.

Definition of distributive education. - Distributive education is specialized education for those persons who sell a service or a commodity or for those engaged in the marketing and merchandising occupations involving customer contact. The distributive education program has two phases. The first phase is the in-school program which consists of an arrangement between the school and local business establishments whereby boys and girls attend school half a day and work the other portion of the day under the supervision of a representative of the school. The second phase is the adult training program for supervisory, sales, and service personnel who are directly engaged in merchandising activities or are in contact with buyers or sellers when distributing goods or services to consumers, retailers, jobbers, wholesalers, and others. The distributive education program has been in operation under the auspices of the federal vocational acts[1] for about thirteen years. During this period, 1938-1950, approximately 200,000 pupils were enrolled in coöperative distributive education classes in the schools of the nation. In the beginning, relatively few states took advantage of the federal funds available for training in this vocational area; however, only three states, Idaho, Nevada, and Rhode Island, reported no enrollment in coöperative distribution education classes during the 1949-1950 school year.[2]

There has been an outstanding growth in enrollment in the coöperative distributive education classes during the years since its inception. Beginning in 1938, there were only 3,600 pupils enrolled in these classes. This number increased eight times by 1950 to a total enrollment for that year of 29,941.

Principles, Practices, and Evidences

A search was made for a list of definitive principles of in-school distributive education to be used as a basis for the criteria. In addition, state supervisors of distributive education were consulted concerning the need for a definitive list of principles. Although many worth-while suggestions were secured from various sources, no comprehensive definitive list of principles was found. Consequently, a tentative list of guiding principles governing the operation of a local and state in-school distributive education program was developed. This list was based on the literature on distributive education, state plans for distributive education, the statements of state supervisors of distributive education, personal interviews with authorities, and the personal experiences of the research worker.

Organization of the groups used. - Three groups were used in the refining and validation of the principles and in interpreting them. These were the primary development committee, local resource personnel, and the evaluating committee. The primary development committee was composed of recognized authorities in the field of distributive education. Twenty-four persons from various areas of education composed the group of resource persons, who were asked to serve on the basis of their field of specialization, which related to a given category in the list of principles. The evaluating committee was made up of representatives of groups which work with the in-school distributive education program and, therefore, the most logical group to use in validating the data. Represented on the evaluating committee were persons from the Office of Education, state directors of vocational education, state, local, and area supervisors of distributive education, state and local school superintendents, high school principles, national, state and local secretaries of merchant associations, merchants, and local distributive education coordinators.

Development of principles, practices, and evidences. - The tentative list of principles was submitted to the primary development committee, the members of which made suggestions for revising them. Each of the principles was then delineated in a series of actual practice statements to portray the way in which it was operative. The actual practice statements were used as bases for developing a list of evidences for determining the degree to which each principle was operative. An example is given here of the manner in which the principles were delineated in a

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series of actual practice statements and a list of evidences:

Principle III. (a) The local school administration should give professional leadership to the distributive education program.

In actual practice this means that the school administration (1) should foster a wholesome relationship with the community and (2) should ensure that the school utilizes all available resources in the development of the program.

Evidences of support of the local school administration: (1) the school administrators attend and participate in distributive education activities; (2) the school seeks the advice of the state division of vocational education in major operational procedures; and (3) the school cooperates with the state division of vocational education in its various activities in the distributive education area.

Review of principles, practices, and evidences. - Resource persons, who are recognized authorities in their respective fields, were consulted next, in most instances on the practices and evidences of only one principle each.

Again, the primary development committee was consulted. This committee reviewed the principles, practices, and evidences, and made suggestions for additions to, modifications of, and deletions from the statements. Revisions were made on the basis of the suggestions of the committee.

Validation of principles, practices, and evidences. - The nationwide committee validates the statements of principle and practice. All of the suggestions made by members of this committee were considered in a final revision of the principles, practices, and evidences.

The principles of in-school distributive education which were developed as a part of this study are listed here.

1. Every community should provide the type of distributive education program that is best suited for its youth in keeping with employment opportunities and the aptitudes, interests, and abilities of its youth.
2. Distributive education should be an integral part of the total educational program in the local community.
3. The local school administration should give professional leadership to the distributive education program. The local school administration should provide personnel, physical facilities, and opportunities in keeping with the ability of the community toward the realization of the aims and objectives of the distributive education program.
4. The merchants should give active support to the school in the operation of the distributive education program.
5. The organization of the distributive education program should be consistent with a democratic philosophy of modern school administration.
6. All available resources in the school and community should be utilized in the accomplishment of the guidance functions. The guidance personnel, the distributive education personnel, and merchants should cooperate in the performance of the guidance functions.
7. The local distributive education supervisor, coordinator, and teacher should have the necessary qualifications and competencies to carry out their responsibilities and obligations, and should do so effectively.
8. The distributive education curriculum should develop skills, understandings, and attitudes that will make the pupil an intelligent, productive, and happy participant in the social, economic, and political life of the community. It should provide practical supervised work experience. The instructional materials and methods should conform to modern business practices.
9. A state department of education should ensure that there is recognized responsible leadership in the distributive education area on the state level.
10. A state department of education should ensure that effective pre-service and in-service teacher-training programs are developed and maintained.

Each principle was interpreted as shown in the illustration of Principle III (a). The next step in the development of the principles, the interpretive statements, and the evidences came with the preparation of the evaluation instrument.

The Evaluation Instrument

At the outset of the study a decision was made to adhere closely to accepted evaluation forms used by other educational groups. In this way it would be possible to profit by the familiarity which educators had with these forms, many of which had features in common. For example, the evaluation instrument is usually divided into sections, each section containing a statement of principles followed by several statements of practice, or questions relating to practices, which are rated. At the end of each of these subsections there is a summary evaluation statement, or statements, from which a numerical result may be derived. A summary sheet is usually provided. Additional space is given for comments on activities not covered by the list of evidences. In addition, there are suggestions for using the instrument. These features became a part of the plan for the instrument to be used in a tryout in the distributive education program.

The plan for using the evaluation instrument developed in the study includes a series of evaluation sessions in local communities and an evaluation session in the state department of education.

Two separate manuals were prepared. The first manual was "Criteria for Evaluating a State-Wide In-School Distributive Education Program," which is referred to in this study as the "Criteria." This manual contains all of the material necessary for use by members of the local committee.

The Criteria. - The body of the "Criteria" is divided into the following ten sections:

I. Establishment in the Local Cummunity
II. Attitude of School
III. Support of Local School Administration
IV. Support of Merchants
V. Organization Structure of the Local Program
VI. Guidance of Pupils
VII. The Distributive Education Staff
VIII. The Distributive Education Curriculum and Methodology
IX. State Leadership
X. Teacher Education

The first eight sections pertain to the local community, and the final two to the state. Each section begins with the statement of a basic principle, followed by a series of questions which are based on the statements of interpretation. Each question is followed by a series of statements, which are based on the compiled list of evidences, to determine to what degree, or extent, the principle is operative in a given situation.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Members of the subcommittees evaluate each item and make an appropriate check in the column under "Check List" provided for this purpose. The following ratings are used by the committee members in evaluating each piece of evidence.

√√- provision or condition is made extensively
√- provision or condition is made to some extent
O - provision or condition is limited
M - provision or condition is missing but needed
N - provision or condition is not desirable

A summary statement appears at the end of each subsection. It has five possible completion statements. The committee is to select the statement which summarizes the ratings on the evidences. When the subcommittee checks a particular completion statement, a numerical result is automatically obtained. The completion statements are so constructed as to give a negative result for numbers 2 and 1. Number 5 is the highest obtainable evaluation, 3 representing the medium degree or extent of the activity. An illustration is given here of one subsection taken from the "Criteria" to show how the principles, practices, and evidences were developed into the evaluation instrument.

Principle X. - A state department of education should ensure that effective pre-service and in-service teacher-training program are developed and maintained.

1. To what extent are teacher-training programs designed to fit the needs in the state? CHECK LIST

   a. The state education division has requirements for institutions offering professional distributive education courses . . . . . ( )

   b. The teacher-training institution meets the state requirements . . . . . ( )

   c. The number of teacher-training institutions offering professional distributive education is limited to fit the needs . . . . . ( )

EVALUATION: The state education division limits the number of teacher-training institutions . . . . . { 5 ( ) to a great extent; 4 ( ) to a high degree; 3 ( ) to some extent; 2 ( ) very little; 1 ( ) none

A two page summary sheet given at the end of the "Criteria" consists of a series of positive statements based on the questions under each of the ten main sections and a chart for entering the numerical evaluations.

How to use the critieria. - The second manual is entitled "How to Use the Criteria for Evaluating a State-Wide In-School Distributive Education Program," and contains complete instructions on conducting the local and state evaluations. Part I includes material on the local community evaluation, Part II on the state evaluation. Each of the two parts is divided into three sections: procedure for evaluation, information for the committee, and information for subcommittees. This manual includes forms and a coded list of information to be used in collecting the data for the evaluation meetings. The code numbers refer to the evidences listed in the "Criteria."

Refining the criteria and the evaluation instrument. - Two objectives were inherent in the plan for the tryout of the instrument: first, to evaluate the instrument in an actual situation and, second, to revise the instrument in the light of the suggestions made by the tryout committee. Springfield, Ohio, was selected as the tryout community for the section on the local community, and the section on the state was studied in a tryout conducted in the Ohio State Department of Education.

Tryout in a Local Community. - An evaluation committee established for the evaluation in Springfield, Ohio, was made up of eleven local persons and three representatives of the State Department of Education, placing a greater emphasis on the part to be taken by the local community. The local representatives on the evaluation committee included the local school superintendent, the local high school principal, and selected representatives from the high school faculty, distributive education pupils, and retail business employers and employees. This full committee was divided into three subcommittees for the purpose of rating the evidences and completing the evaluation statements in the "Criteria."

The time allotted for the evaluation was an evening and two full days. In each instance the committee members first familiarized themselves with the coded information. Then other sources of information were explored and the job of filling in the check list items was begun. At many stages during the process resource persons were consulted. Also, some members of the committees went on observational tours in the school and in the downtown business district where distributive education pupils were employed. The full committee considered the ratings and evaluations made by the subcommittees.

For the purpose of obtaining an evaluation of this tryout experiment, an observer who had studied the material previous to the meeting was assigned to each subcommittee. An observer in each subcommittee took notes on all aspects of the work of the subcommittee and also on the meeting of the full committee. The observers made recommendations for revision of the criteria and the evaluation instrument.

All recommendations made by the committee members and observers were utilized in the revision of the criteria and the evaluation instrument. Plans were then set in motion for the state tryout.

Tryout in the State Department of Education. - The tryout in the State Department of Education followed the same general pattern as the one conducted in the local community. A date for the meeting was set, arrangements were made for a meeting place, persons were invited to serve on the evaluation committee, materials were assembled for the subcommittees, subcommittee chairmen were informed of their duties, and the state chairman was given instructions concerning his part during the meeting.

The tryout was set for one day. The persons who served on the committee were as follows: a high school principal, the research secretary of the state merchants' association, a professor of education, a professor of business organization, a distributive education coordinator, and the assistant state supervisor of trade and industrial education.

A part of the planning for the meeting was the preparation of a summary sheet of hypothetical evaluations of local programs. This sheet included five evaluations for the subcommittee to use in one phase of the tryout. The summary of the Springfield evaluation was used as one of the five summaries. The other four were the result of the

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research worker's experience. Four actual communities were used as background for preparation of the summary, without conducting an actual evaluation.

Observers were also used in connection with the state evaluation. The report of the observers was considered in the revision of the criteria and the evaluation instrument.

Summary. - As a result of the procedures followed in the study, criteria and an evaluation instrument have been developed for evaluating a state-wide in-school distributive education program. The instrument is intended to evaluate the effectiveness of local distributive education programs and the professional services provided by and through the state department of education.

One important element in the recommended evaluation procedure is the extent to which local participation is utilized. The educative values derived by participation of local personnel constitute one of the major benefits of the evaluating procedures recommended and followed in this study. Through participation in the evaluation, members of the local community became fully informed of the values and limitations of the local distributive education program.

Two twenty-four page manuals were prepared. The first manual included all of the material necessary for use by members of the evaluation committees. The second manual includes instructions for conducting the local and state evaluations. 302 pages. $3.90. Mic 58-4243

Abstract published by special arrangement with The Ohio State University.

1. Federal funds were made available for the training of distributive workers through provisions in the George-Deen Act of 1936. Further provisions for vocational distributive education were included in the George-Barden Act of 1946.

2. Office of Education. Digest of Annual Reports of State Boards for Vocational Education. Washington, D. C.: Government Printing Office, 1950, p. 87.

A COMPARATIVE STUDY OF THE EFFECTS OF AN ENRICHED PROGRAM FOR THE TALENTED IN ADVANCED ALGEBRA CLASSES

(Publication No. 24,831)

Roy Gilbert Long, Ed.D.
Indiana University, 1957

Chairman: Philip Peak

Problem

The purpose of this study is to determine the effectiveness of an enriched program of instruction upon the talented and non-talented student in advanced algebra as they are found in heterogeneous classes. It is an attempt to answer the following three questions:

1. Do talented students in mathematics show significant educational gains from a curriculum enrichment program carried out for them in a regular classroom situation?

2. What happens to the educational achievement of the non-talented in mathematics in a regular classroom when enrichment is offered to the talented in their classroom?

3. Are there any changes in attitudes and interests in mathematics of either the control or the experimental groups during the period of curriculum enrichment?

Procedures Used in This Study

The study was confined to the students enrolled in four advanced algebra classes at Bosse High School, Evansville, Indiana, during the school year 1955-1956. Ninety-eight students were enrolled at random by the office in these four classes. All of the classes were taught by the writer. Two of the classes were selected at random as the experimental group and the other two classes were the control group.

The students were tested at the beginning of the experiment by the Otis Quick Scoring Mental Ability Test, Davis Test of Fuctional Competence in Mathematics, and the Cooperative Intermediate Algebra Tests. Comparisons of the experimental and control groups were made by use of the "t" test on the difference between the means and the "F" test on the difference between the standard deviations.

On the basis of only the Davis and Cooperative test scores 15 top students in the experimental group and 11 top students in the control group were selected as the talented in mathematics. Other comparisons were also made on the talented and the non-talented of the two groups. To further compare the two groups a grade point average was computed on each student for his grades in mathematics only.

Enrichment procedures used only with the experimental group included talented students serving as group leaders, presenting new topics and materials to the class, giving special reports and projects, and participating in mathematics contests. Activities for all of the experimental group included weekly review sheets, extra-credit problems on the tests, and special projects. Both the control and the experimental groups received the same basic instruction, topics, assignments, and tests.

At the end of the experiment another form of the Davis test and the Cooperative Algebra test was given to all and comparisons of the groups, the talented, and the non-talented were again made.

An attitude questionnaire was used at the beginning and at the end of the experiment. Comparisons of the attitudes and practices were made between the groups.

Findings

Findings for this study may be summarized as follows:

1. On the basis of the tests administered at the beginning of the experiment there were no significant differences between the means of the two groups.

2. On basis of the same tests there were no significant differences between the talented of the groups or the non-talented of the groups at the beginning.

3. On basis of grade point average in mathematics there was no significant difference between means of the groups at the beginning.

4. On basis of the Cooperative test scores at the end of the experiment the experimental group had significantly higher means than the control group for both the talented and the non-talented in the group.

5. On basis of the Davis test scores at the end of the experiment, the means of the groups were not

significantly different for either the talented or the non-talented.

6. The questionnaire revealed that a majority of the students were going to college, going to study more mathematics, and going into technical professions where mathematics is going to be needed as a background.

Conclusions

The conclusions drawn are claimed only for the data obtained in this study. The conclusions are as follows:

1. Achievement in algebra was greater for the talented of the experimental group than the talented of the control group.
2. Achievement in algebra was greater for the non-talented in the experimental group than for the non-talented in the control group.
3. Enrichment proved worthwhile activity in the experimental group for both the talented and the non-talented.
4. Enrichment activities produced a little more favorable attitude and approach to the study of mathematics in the experimental group. 238 pages. $3.10. Mic 58-4244

THEORIES OF SCHOOL AND SOCIETY AND THEIR IMPLICATIONS FOR SCHOOL ADMINISTRATION

(Publication No. 25,162)

Conrad Dell Mang, Ed.D.
The University of Texas, 1957

Supervisor: Professor Dr. Frank C. Wegener

The Problem:

This study was based on the assumption that theories of school and society have direct implications for school administration and that certain practices of school administration depend on intelligent interpretations of these theories of school and society. The problem as stated specifically follows:

1. What is the meaning and significance of the following theories of school and society as advocated by the following men: Reconstructionism as interpreted by Theodore Brameld; Instrumentalism as advanced by John Dewey; Essentialism as presented by Isaac Kandel; and Classical Humanism as advaned by Robert Hutchins?
2. What are the consequences and direct implications from theories of school and society for school administrative practices? What are the practical values to administration that are derived from this study?

Procedure:

The theoretical concepts of the four men studied were organized around five general areas: philosophical assumptions, the present situation in American education today, criticism by authors, the unique contents of select theory, and the school's role in society. The implications for administration were found to be significant in the following areas: curriculum aims, curriculum content, curriculum methods, educational control, academic freedom, public relations, and teacher status and training.

Findings:

Hutchins and Kandel stress the absolute and permanent aspects of reality, while Dewey and Brameld stress relativily and change. Instrumentalism and Reconstructionism are concerned with changing the culture, while Essentialism and Classical Humanism place more emphasis on conservation of culture. Reconstructionism and Instrumentalism view man more as a social animal, while Essentialism and Classical Humanism tend to emphasize man as a rational animal. Reconstructionism determines values by social consensus. Instrumentalism would determine values by the use of methods of scientific experimentation. Essentialism and Classical Humanism both turn to philosophical inquiry to determine values.

Brameld and Dewey characterize the present situation today as one where the forces of reconstructionism are held back by the conservative "status quo" groups. Hutchins and Kandel characterize the present time as one in which materialism and faith in science have led to a destruction of moral faith and intellectual standards.

Brameld feels that school control should be in the hands of the community working through many councils and advisory groups, while Hutchins takes an opposite view that control remains largely in the hands of the professional educator. Dewey views the community and administrator as a parallel relationship sharing in control of the school, while Kandel views control as delegated responsibilities that are writtten out specifying certain duties.

Brameld holds that the aims of education are social-self-realization, and the context of curriculum is found in developing future goals for society. Dewey derives his aims from the child who is in a process of growth as well as from a society in the process of reconstruction. Kandel speaks of two aims: transmitting the cultural heritage and developing leaders for a democracy. The context is found in a general education. Hutchins aims to promote wisdom and goodness, and the context is the liberal arts and great books.

The method of reconstructionism is group interaction, such as group discussion, debates, seminars, and role-playing. The method of the instrumentalist is problem-solving by the scientific method as children work on projects and activities. The essentialist relies heavily upon the teacher for learning experiences, while agreeing with the classical humanist on more activities involving the philosophical inquiry. The classical humanist looks to the method of the philosopher, as debates, criticisms, and dialectics.

It was concluded that these theories of school and society have definite and, in many cases, different consequences for school administrative practices, particularly in the areas of school control, public relations, curriculum aims, and methods of instruction. 451 pages. $5.75. Mic 58-4245

BASIC ISSUES IN FARM MECHANICS EDUCATION WITH IMPLICATIONS FOR THE PRE-SERVICE EDUCATION OF TEACHERS OF VOCATIONAL AGRICULTURE

(Publication No. 25,247)

John Wilbur Matthews, Ph.D.
University of Illinois, 1957

The chief purposes of the investigation were: (1) to discover and identify important basic issues in farm

mechanics education, (2) to obtain evidence bearing on these issues, and (3) to apply conclusions drawn to improvement of farm mechanics programs, and specifically to replanning the pre-service teacher education program in farm mechanics at the University of Illinois.

Methods and Procedures

The following procedures were used:

1. A list of basic issues in farm mechanics education was developed.
2. The progress of mechanization on Illinois farms since 1920 was studied.
3. Selected literature in education and agriculture was reviewed.
4. Interviews were conducted with two groups of young farmers, with a selected group of Illinois teachers of vocational agriculture, and with selected individuals in businesses and professions related to farm mechanics.
5. Data from all sources were analyzed and summarized.
6. Conclusions were drawn and applied to a proposed pre-service teacher education program in farm mechanics at the University of Illinois.

Major Issues Evolved

Following are some major issues investigated:

1. What are the farm mechanics needs of school and out-of-school students, and of present and prospective teachers?
2. How should farm mechanics needs and objectives be determined and expressed?
3. By what criteria and by whom should farm mechanics programs and students' progress be evaluated?
4. What is the optimum relationship between farm mechanics instruction and students' farming programs?
5. To what enduring human values may farm mechanics contribute?
6. How should farm mechanics instruction be integrated into total educational programs?
7. How can students' interests be developed and guided in the farm mechanics instructional process?
8. What are the most effective procedures for teaching skills, understandings, attitudes, and appreciations in farm mechanics to individuals and to groups?
9. How can students be taught to solve mechanical problems and to exercise adequate mechanical judgments?
10. What are the basic determinants of school and home farm shop facilities?
11. To what extent is the effectiveness of farm mechanics programs influenced by the farm mechanics education received by teachers?

Implications for Pre-Service Teacher Education

Conclusions drawn suggested the following principles for organizing a pre-service teacher education program in farm mechanics:

1. Course objectives should be determined and stated in terms of student needs and abilities to be developed.
2. Students should participate in planning, setting goals, and evaluating outcomes of instruction.
3. Provision should be made for individual differences and previous learning experiences of students.
4. Considerable importance should be placed on developing abilities and understandings in farm power and machinery, with emphasis on maintenance, service, and field adjustment.
5. Efforts should be made by instructors to awaken, guide, and develop students' interests through educationally sound instruction related to problems and needs of teachers of vocational agriculture.
6. Students should be provided ample opportunity to solve problems and exercise mechanical judgments.
7. Attitudes and appreciations should be taught by example and units of related instruction.
8. Course content should be revised frequently to keep abreast of new developments.
9. Opportunities for student guidance should be utilized fully.
10. School shop facilities should have a positive influence on University facilities, but the University should assume a position of state-wide leadership in providing adequate shop facilities for farm mechanics.
11. Pre-service teacher education in farm mechanics should not be considered terminal. Opportunities should be provided for the development of additional farm mechanics abilities through graduate and other in-service courses for teachers.

279 pages. $3.60. Mic 58-4246

AUDING ABILITY RELATED TO ACHIEVEMENT IN TWO TELECOURSES

(Publication No. 25,355)

Edward Leon McClarty, Ed.D.
Stanford University, 1957

The purpose of this study was to determine experimentally the relationship between auding ability (hearing, listening, recognizing, interpreting and comprehending spoken language) and achievement in two college-level courses, which were taught through the television medium and without television. This study was designed to be a part of the San Francisco State College Project in Educational Television. Data were collected at San Francisco State College where a freshman psychology course and a sophomore economics course were taught by television (experimental) and without television (control).

The relationship between auding ability and achievement was tested for significance in markedly different

learning situations: television at home; television in a viewing group on the college campus; a control situation which used lecture as the major method of instruction; a control group which used group discussion as the main method of instruction; television instruction which used mainly lecture; and television instruction which used a large number of live and filmed dramatic illustrations.

Achievement was determined both by gains on criterion tests and course grades.

To test the significance of the auding-achievement relationship, 2 x 2 contingency tables were used. Auding ability was dichotomized along one margin and achievement along the other. For N's of 29 and larger, chi-square was calculated and P was determined from appropriate statistical tables; for N's smaller than 29, P was calculated by Fisher's exact probability procedures.

Regardless of the type of auding dichotomy used, no significant relationship between auding ability and gains on the criterion test was found in any learning situation or combination of situations. In the economics course by home-television, the auding-grades relationship was significant at the .05 level. A combination of all economics situations produced an auding-grades relationship significant at the .001 level. A combination of all psychology situations, with auding ability dichotomized into top and bottom thirds, resulted in an auding-grades relationship significant at the .02 level.

Conclusions:

1. The findings do not support a hypothesis of a relationship between auding ability and gains on the criterion tests.

2. The findings support the hypothesis that auding and achievement would be most highly related in the home-television situation which used mainly lecture.

3. The findings of a significant relationship ($P<.001$) between auding ability and grades in a combination of all economics courses compared to a lack of significance ($P>.10$) in a combination of all psychology courses supports the hypothesis that auding would be more highly related to student achievement in situations in which lecture, rather than visual material and discussion was the main method of instruction.

4. The finding of highly significant relationships ($P>.001$) between auding ability and criterion pre-test performance in psychology and economics suggests that auding ability is highly related to general information and to an understanding of fundamental concepts in both disciplines.

5. The fact that the relationship between auding ability and post-test performance was not significant ($P>.30$) in only one situation -- Psychology control -- supports the hypothesis that auding would be least important to achievement in this particular situation. It appears that group discussions with sufficient time for questions, clarifications and interaction minimize the importance of auding as a determinant of achievement.

124 pages. $2.00. Mic 58-4247

A STUDY OF SOME CONCEPTS IN ALGEBRA AS USED BY WRITERS OF HIGH-SCHOOL TEXT-BOOKS

(Publication No. 25,268)

Nageswari Rajaratnam, Ph.D.
University of Illinois, 1957

Teachers of mathematics and writers of mathematics text-books are becoming aware more and more of the great need for improving the treatment of this subject in schools today. They are realizing that the logical possibilities of the subject have to be taken into consideration if one is to foster in children the type of thinking necessary for the development of a mathematical approach to the solution of problems.

Although it is not possible to teach most ideas in all their complexity at the earlier stages, it is still possible to deal with them in such a fashion that what is taught in the early stages does not run contrary to what is to be taught in the later stages.

In the attempt to simplify the subject matter of teaching, text-book writers seem to have lost sight of this principle. Most high-school text-books are full of logical inconsistencies and outworn ideas. Their treatment of concepts such as those of variable, function and equation is very inadequate and confusing. These concepts are basic to a clear understanding of mathematics, and incorrect treatment of these could lead to difficulties in later learning.

This study was therefore designed to go into this problem in order to try to show those interested in the teaching of high-school mathematics the types of inconsistencies that one meets in this area. The concepts dealt with are those of variable, function, equation, and equality.

For this purpose it was necessary to establish some criterion by which to measure the treatment of those concepts in the text-books studied. This criterion was developed from a study of the work done by mathematicians and logicians such as Max Black (1), Church (6), Alfred Tarski (7), Bertrand Russell (8), Rosser (9) and Kerschner and Wilcox (10). The findings of this part of the study are given in the first part of this thesis.

The second part of the study involved a close examination of a random sample of ten elementary algebra text-books published either in original form or in revised form since January, 1953, both in the United States and in Great Britain. The findings with respect to the way in which the concepts have been treated in these text-books is given in the second part of this dissertation.

In the course of this examination it was found that most of the modern ideas about the concepts covered were already beginning to appear in the text-books. However, none of the books had incorporated all the new ideas, and even those new ideas which had already been introduced had not been adhered to consistently. The new ideas were mixed indiscriminately with outworn and erroneous ideas and terminology.

The findings of this study have been supplemented with suggestions for bringing the treatment of these concepts consistently into line with modern mathematical usage. They are, however, in the nature of tentative suggestions and have to be subjected to empirical investigation with regard to ease of learning, effect on further learning and other aspects of the learning situation. It is therefore

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hoped that further studies will deal with these problems in the near future. 155 pages. $2.00. Mic 58-4248

A STUDY TO IMPROVE EDUCATIONAL PROGRAMS AND FACILITIES FOR THE YOUTH IN THE SECONDARY SCHOOLS OF THE RURAL AND VILLAGE SCHOOL DISTRICTS OF GROTON, NEWBURY, RYEGATE AND WELLS RIVER, VERMONT

(Publication No. 21,727)

Paul S. Ross, Ed.D.
New York University, 1957

The purpose of making this study was to determine the most feasible and promising plan for improving the secondary educational facilities and programs of the rural and village school districts of Groton, Newbury, Ryegate and Wells River, Vermont, and to make recommendations for implementing this plan. It was proposed to gather data as to: (1) the historical backgrounds of the four school districts as a means of better understanding present attitudes and beliefs toward education; (2) the kinds of secondary education wanted by the people for their youth; (3) trends in population, both total and school, and the problems of a decreasing population; (4) the limitations imposed in matters of school sizes and future needs of expansion; (5) the alternative possibilities for improving and extending the secondary-school programs and facilities, either individually or collectively; (6) the financial and other resources of each district which could be utilized to achieve improvements. It was proposed, as an outcome from the above, to draw conclusions and to make recommendations in accordance with the data collected and evaluated.

The program of providing an acceptable program of secondary education for the youth of these communities had been growing increasingly complex and difficult because of mounting costs per pupil, unavailability of qualified teachers with versatile skills, reduced program offerings, limited budgets, and obsolete facilities and equipment. Extremely small pupil enrollments placed the high schools in these districts among the nine smallest in numbers and among the fifteen highest in cost per pupil in Vermont. The total population of two of the four districts had decreased as much as one-third in the last half century, with the other two districts barely maintaining status quo. Taxes were believed to have reached, or nearly reached, ceilings of levy. The growing concern over this problem was climaxed by one district voting to close its high school within a short time unless some satisfactory way to provide better education at present levels of cost could be found. All of these conditions combined to make the need for a careful study imperative and immediate.

The methods used in securing and presenting the data included the use of techniques which seemed most appropriate and suitable to this study. These included references to the recorded thinking of others; use of factual data developed and recorded locally from original sources; use of data developed by the Vermont State Department of Education and other related sources; use of a carefully prepared questionnaire to evaluate the suitability and adequacy of the high-school programs of the past; and the use of groups of lay citizens and professional educators, serving on committees, to assist with curriculum problems and with the interpretation of community attitudes and desires for improved educational opportunities.

It was discovered that these communities wanted good education for their youth and were willing to support same within their ability to finance it. The four districts were found to be located in a section of Vermont having low taxable wealth potential, these districts having considerably less ability to support education locally than have the other sections of the state. A study of school records revealed little change in organization, curriculum, or sizes of enrollments in these high schools during the past few years. In view of the comparative standings of these schools with others in the state, the expressed intention of the State Department of Education to expect regular and continued progress to raise the standing of the high schools in the state, and the realization that present and predicted future enrollment numbers in these schools showed little hope of growth, it was felt that some new solution to the problem must be sought.

Several alternatives were considered and investigated. Among these were the closing of the existing high schools, depending on nearby schools with better facilities to provide services; development and use of shared or cooperative services among the schools to augment and supplement present curriculum services; and the formulation of a union high school district for the purpose of creating and operating a union district high school of grades seven through twelve. The last named solution was found to offer the greatest promise of meeting the hopes, aspirations and needs of these districts.

The recommendation to form and operate a union district high school was developed in a practical manner in some detail, showing that a six-year high school encompassing the pupils from the four districts would provide a school of desirable numbers for efficient and economical operation. This school would meet all regulations and requirements of the Vermont State Department of Education, and would provide a wide range of curriculum patterns and offerings sufficient to meet the broad needs of these districts. The recommendations included a careful analysis of building and staff needs and estimated operational costs. A schedule of payments for the amortization of the buidling indebtedness was prepared. Estimated costs per pupil for the proposed school were computed and found to fall considerably below present actual costs per pupil in high school in these districts.

A final consideration was the development of a plan for acquainting the public with the recommendations and findings of the study. Various techniques and media of public relations were explored and considered in the light of established and accepted principles of good public-relation programs. A plan which had proven its worth in similar projects, known as the "kitchen visit" technique, was recommended as the one most likely to promote the greatest understanding and support for the program developed.

Although this study is concerned with a particular problem in a particular area, it can be expected that the pattern of investigation will prove useful and of value to other investigators who may be faced with similar, even though completely unrelated, problems.

240 pages. $3.10. Mic 58-4249

A FRAMEWORK FOR DEVELOPING MAP SKILLS IN PRIMARY GRADE SOCIAL STUDIES

(Publication No. 25,358)

Rose Epstein Sabaroff, Ed.D.
Stanford University, 1957

The overall purpose of map-making and map interpretation in the primary grades is to help children develop a geographic point of view--a spirit of inquiry, throughtful exploration, into the differences in the ways that men carry on their basic activities in differing natural and cultural settings.

The present study set itself four major tasks. The first two are research tasks: (1) to analyze the research in child development and the learning process to discover children's potentials, (2) to analyze the literature in geography and social studies to discover what map skills and geographic understandings experts in these fields think children need to have; the remaining two tasks are an application of the foregoing research to curriculum: (3) to provide an overall program for map-making and interpretation within the social studies design, and (4) to develop detailed sequences of pupil experiences for classroom use in grades one, two, and three.

From the psychological studies reviewed in this dissertation of child growth, children's interests, children's concepts (especially concerning space and time), and children's ability to reason and generalize, it became evident that maturation depends both on physical growth and the nature of the experiences provided. Young children's interests center mainly on people and things within their zone of direct contact. Their talk is mainly concerned with objects and events in the immediate environment which affect them personally. Their most accurate concepts are largely confined to the here and now. Gradually, as children's experiences are extended, interests and concepts mature and move outward in time and space. Primary school children are able to reason and generalize if the subject matter and methodology of presenting a problem is kept within their range of experiences.

From the geographic literature, four major objectives have been identified for development at each grade level: (1) Ability to observe thoughtfully, (2) Ability to reason about things geographic, (3) Ability to reorganize and present in some map form what has been observed, and (4) Ability to read through the symbols of maps made by others to the landscape and realities thus represented.

In achieving these objectives, ten groups of map skills and understandings will be developed in pupils:

1. Ability to observe thoughtfully.
2. Ability to orient self and note directions.
3. Ability to use scale and estimate or measure distance.
4. Ability to locate on maps and globes.
5. Ability to recognize and express relative location.
6. Ability to understand symbols and associate imagery with the landscape and realities thus represented.
7. Awareness of natural-cultural relations.
8. Ability to understand time relations.
9. Ability to recognize physical features.
10. Ability to recognize the globe as a model of the earth on which we live.

Achievement of these objectives and development of these skills will begin in the first grade. Thereafter, succeeding experiences will reinforce and extend these skills to the level deemed possible with each age group in the light of their previous experiences.

These skills and understandings will be developed within a social studies framework. Eight categories of basic human activities become a checklist of what children might observe in their immediate environment: Protecting and Conserving; Producing, Distributing, Consuming, Transporting; Communicating; Expressing Aesthetic and Religious Impulses; Providing Recreation; Providing Education; Organizing and Governing. At first grade level the firsthand experiences will focus on the Family Community and School Community; the emphasis at second grade will expand to include Our Neighborhood Community; at third grade the children will explore Our Local Community, be it town, city, county, or metropolitan area.

Trips taken into the immediate environment, through thoughtful and directed observation, become the basis for all map-making and map-thinking. What has been observed is reorganized and geographic relations made explicit through guided discussion, dramatic play, and map-making. Map-making and map interpretation follow a sequence from crude three-dimensional constructions to pictorial, semi-pictorial and abstract representations.

At each grade level a detailed sequence of pupil experiences is suggested within that grade's emphasis: home and school, neighborhood, or local community. There is a continuity and progressive development of map skills and geographic understandings each year and throughout the three years.

It is hoped that the sequences developed in the present study will become a working hypothesis for furture researchers to subject to rigorous investigation in the classroom. 371 pages. $4.75. Mic 58-4250

A COMPARISON OF THE INTELLECTUAL DEVELOPMENT OF JOHN DEWEY AND WILLIAM H. KILPATRICK WITH IMPLICATIONS FOR DIFFERENCES IN THEIR EDUCATIONAL THEORIES

(Publication No. 24,929)

George Gershon Swimmer, Ph.D.
Northwestern University, 1957

The purpose of the study is to present a comparative analysis of the formative influences in the intellectual development of John Dewey and William H. Kilpatrick, and to determine the extent to which differences in the course of this development are similarly reflected in selected aspects of their published educational thought.

The major hypothesis of the study may be stated as follows: In spite of the common adherence on the part of Dewey and Kilpatrick to the philosophy of experimentalism, there exist some differences in interpretation and emphasis between them with respect to educational theory and values.

The data and conclusions presented in this study are divided into two main divisions. The first part of the study provides an extensive historical research into the formative intellectual influences upon the two men and identifies the primary concepts and ideas which governed

their subsequent thought. The second division extends this comparison by focusing on the contrasting opinions and interpretations found in their respective expositions of the educational process.

Sufficient disparity of thought became evident, after an examination of both the historical and educational sources, to support the acceptance of the hypothesis. The differences noted are outgrowths of the concern, exhibited on Dewey's part, with a thoroughly worked out philosophy of experience. This philosophy is grounded in the concepts of organic interaction, continuity, and the central role of intelligence and reflective thinking as criteria of, and the mode of valuation in, experience. These concepts are traced from their origins in Dewey's early idealistic thought and their subsequent reconstruction in his shift to instrumentalism. In Dewey's thought, educational doctrines are derived directly from philosophic foundations inherent in his theories of knowledge and value. Learning, interest, curriculum and experience are inextricable bound up with Dewey's concept of inquiry. In his view, only when activity is combined with reflection do objects of knowledge result which are instrumental in directing future experience. Dewey places great stress on intelligence as the best means of mediating pupil interests, impulses and desires by bringing to bear powers of observation, memory, and the critical use of the organized knowledge and inherited values of civilization. Educational method is thus based on the process of inquiry and the subject-matter of the curriculum must be planned and organized in ways that lead to progressively better ordered resources of knowledge.

Kilpatrick's educational thought was greatly influenced by his own teaching practice and association with other educators. Early in his career he became attached to the doctrines, pupil-initiative, and functional activity as valuable means of correcting the weaknesses and faults of traditional educational practices. He emphasized biological and naturalistic elements of Dewey's thought and interpreted the meaning of activity, experience, and interest, not in the context of reflective thought of inquiry, but as relatively unqualified educational values. His emphasis on action rather than reflection as the creative aspect of experience, his stress on personal satisfaction and emotional adjustment in learning, and the rejection of the use of organized subject matter in curriculum are the major areas of difference in educational doctrines considered in the study.

In conclusion, the findings of the study point to definite differences in the intellectual development of Dewey and Kilpatrick and to varying interpretations of experience, learning, and curriculum in educational theory.

This suggests that not all practices derived from Kilpatrick's concept of the "project method" and the role of activity in education are supported by the tenets of Dewey's instrumentalism. Kilpatrick's theories, therefore, should not be equated with those of Dewey.

268 pages. $3.45. Mic 58-4251

A HISTORY OF MEDICAL ORGANIZATION AND COUNTER-ORGANIZATION IN THE UNITED STATES

(Publication No. 21,723)

Lorraine Welch, Ph.D.
New York University, 1957

Chairman: Professor Frederic M. Thrasher

This study undertakes to examine the effect which conflict between orthodox medical groups and practitioners of the newer healing arts -- "non-medical doctors" as they often style themselves -- has had upon licensing and educational standards of the latter groups. The study is confined to an examination of three of these healing arts groups -- namely, chiropractic, osteopathy, and optometry. The importance of this investigation lies in the fact that educational requirements in these fields have been established, apparently, as a result of conflict between these groups and organized medicine.

The study does not purport to be a history of medicine, or even a history of any of the protest movements which are discussed and compared. Yet something of the history, both of organized medicine and surgery, and of the protest movements in organized medicine has, of necessity, been concluded. It is only against such a historical background that the theoretical base from which protest movements in organized medicine have developed can be appreciated and understood.

Four general subproblems are developed by the thesis. The first of these involves tracing of the development of organizations within the new systems. Hostile actions and statements by medical organizations and their spokesmen are examined, to make clear the early opposition on the part of organized medicine which stimulated counter-organization. The formation, structure and activities of the counter-organizations are examined.

The second subproblem involves description of opposition of the American Medical Association to the rival organizations. The basis of the opposition, as well as the methods used for its expression and the degree of their success are determined. An examination has also been made of the literature of propaganda, educational requirements demanded, and attempts to secure legislation unfavorable to the new groups.

The third subproblem involves description of the activity of the counter-organizations in meeting this opposition. Methods of counterpropaganda are detailed. Proposals and actions undertaken by these groups to meet the criticism and examined.

The fourth subproblem involves determination of results of these activities on attainment of objectives of the new groups, and on educational standards. The current status of the professions, particularly in regard to such matters as state licensing, recognition by insurance companies in regard to claims, and Federal government recognition in respect to compensation claims is examined. Current licensing and educational standards are discussed, and the role of medical organization and counterorganization in establishing these standards is described.

This procedure yielded data as a result of which the writer has been able to describe and discuss the development of medicine and surgery, the early standards of education, both in medicine and in counter groups, the

developing need for organization among counter groups, the formation of those organizations, and the current status of the healing professions, chiropractic, osteopathy, and optometry considered.

The study has yielded the following conclusions: (1) ignorance, and the paralyzing opposition to new ideas, has profoundly affected the development both of organized medicine and protest movements that have grown within it; (2) ancient civilizations made contributions to the healing arts not generally recognized: (3) a certain temper of the times is essential to progress and making of new discoveries, and there is much evidence that such a temper prevails today; (4) protest movements in organized medicine contain within themselves a mixture of progress and retrogression, and their end result is a needed and healthy spur to man's progress.

Among applications which may be made of this study the following are significant: (1) useful information is provided for non-specialists in any healing art; (2) it may, the author hopes, serve as some small contribution in bringing about greater homogeneity of standards in medical education nationally. 222 pages. $2.90. Mic 58-4252

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

ENGINEERING, AERONAUTICAL

UNSTEADY COUETTE FLOW

(Publication No. 25,407)

Leslie Alan Hromas, Ph.D.
Purdue University, 1957

Major Professor: Dr. Harold M. DeGroff

The results of the compressible Rayleigh problem involving an impulsively moved flat plate indicate that transverse velocities can be generated by a pure longitudinal shearing motion. It would be desirable to experimentally demonstrate the existence of these waves, and to do so was the motivation for the present investigation. However, the geometry for the Rayleigh problem is prohibitive; and since it was noticed that a similar behavior should occur for the case of unsteady, compressible, Couette flow, this was considered for the present investigation. For the experimental work, circular cylinders were used to simulate the unsteady Couette flow.

In the Rayleigh problem viscous dissipation is the mechanism by which the transverse waves are generated. Due to the presence of a shear flow in the Couette problem an additional coupling between the transverse and longitudinal velocities is introduced in the linearized equations. This allows the problem to be studied independent of viscous dissipation and on the basis of a low speed flow.

The order of magnitude for the transverse velocity in unsteady, compressible, plane Couette flow was obtained by introducing a suitable boundary layer displacement thickness based on the exact unsteady incompressible solution. The rate of change of the displacement thickness was then taken to be indicative of the transverse velocity. It was found that transverse velocity terms in the linearized momentum equation are of the same order of magnitude as those for the longitudinal velocity.

In attempting to demonstrate the existence of any transverse velocity it was found that experimental values for the direct measurement of the velocity profile agreed very well with the theoretical analysis for unsteady, incompressible, plane Couette flow. Since the transverse velocity was thus very small, a temperature gradient was placed across the annulus in order to magnify any effect the transverse velocity might have. Periodic fluctuations in the temperature were then noted. These fluctuations were converted to velocity and determined to be equivalent to a transverse velocity of the order of .003 ft./sec. It was found that these values agreed qualitatively with the analytical calculations. Further, it was found that the magnitude of the transverse velocity was proportional to the imposed temperature gradient, but that a non-zero value existed for no imposed temperature gradient. Finally, an analysis of possible extraneous effects in the experimental apparatus is given, considering in particular, free convection and centrifugal effects. It was concluded that the data obtained were restricted to regions of the annulus free from convection currents, and that although centrifugal effects were of necessity present they could account for only 10-15% of the measured effect.

53 pages. $2.00. Mic 58-4253

IGNITION IN THE LAMINAR WAKE OF A FLAT PLATE

(Publication No. 23,836)

Arthur A. Kovitz, Ph.D.
Princeton University, 1957

The interaction of a cool, combustible stream with its hot combustion products is studied from the point of view of determining where the first local maximum in the temperature profile occurs with respect to the initial contact point between the two flows. This work presents a modification of Marble and Adamson's study of a similar interaction in which the effect preformed velocity boundary layers in the two flows was not considered.

The concept of flame initiation at the boundary between a hot stream consisting of combustion products and a cold, combustible stream has been idealized by Marble and Adamson. They considered two streams of gas, one a cool, combustible mixture, the other its hot combustion products. These streams begin to mix at a certain point and through the processes of mass diffusion, viscous mixing, and thermal conduction a laminar flame finally develops at a certain distance downstream of the initial contact point. The model is considered two dimensional and all significant variations of temperature, concentration, and velocity take place in a very thin layer between the two streams. Because of these assumptions the Prandtl boundary layer approximations are employed to reduce the mathematical complexity without introducing undue error. An important length is introduced and defined as follows: it is the distance downstream from the initial contact point at which a bulge in the temperature profile first appears, i.e., at this distance the heat release due to chemical reaction has been sufficient to raise the local temperature above the initial temperature of the hot stream. This length is considered a measure of the flame holding ability of the system since it is a prerequisite to the ultimate formation of the laminar flame. If this distance is too great then, for a given system with given dimensions, "blow off" will occur.

Marble and Adamson determined this length for a system with first order chemical kinetics assuming that the velocities of the two streams were equal. They also showed that when the velocities were different, this length to first order, depended linearly on the velocity of the hot stream. In both cases this length depended exponentially on the hot stream temperature.

An important restriction on their work is the neglect of the initial velocity profile. That is, they considered the

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initial velocity profiles to be uniform and in so doing were not able to deal with the fact that in any physical system the velocity in contact with a stationary surface (the dividing plate between the two streams) must vanish.

This two dimensional process is approximated by a set of boundary layer type equations which express conservation of energy (including first order chemical reaction), conservation of species (relative concentration of combustible), conservation of momentum, and overall conservation of mass. Under the assumptions that the pressure is uniform and the product of density times viscosity is constant, the Howarth transformation is used to separate the momentum and continuity equations from the energy and species equations. With this separation Goldstein's (2) results for incompressible flow in the wake of a flat plate can be directly incorporated into the energy and species equations.

Two second order simultaneous partial differential equations for temperature and concentration of combustible present themselves for solution, each containing a first order Arhennius factor giving the effect of chemical reaction. These equations are solved using a method similar to that used by Goldstein in obtaining his wake flow results. Temperature and concentration are expanded as a series of functions using integral powers of a parameter which depends upon the length downstream from the initial contact point between the two streams.

Substitution of these assumed solutions into the partial differential equations results in a series of second order, linear, ordinary differential equations for the coefficients in the assumed power series solutions. The two boundary conditions are at ± infinity necessitating a knowledge of the asymptotic form of the equations and their solutions. These are obtained and the asymptotic solutions matched to the numerically obtained solutions valid for small values of the independent variable.

Employing the same physical constants used by Marble and Adamson (the decomposition of Azomethane) the results show that the presence of preformed boundary layers significantly alters the position of the first local maximum in the temperature profile. This length is much shorter reflecting the importance of convection in determining the distribution of heat release due to chemical reaction.

179 pages. $2.35. Mic 58-4254

ENGINEERING, CHEMICAL

LOCAL SHELL-SIDE HEAT TRANSFER COEFFICIENTS IN BAFFLED TUBULAR HEAT EXCHANGERS

(Publication No. 24,621)

Tommy W Ambrose, Ph.D.
Oregon State College, 1957

Major Professor: James G. Knudsen

Local heat transfer coefficients were measured on the shell-side of a baffled tubular heat exchanger. The apparatus used was an electrically heated resistance ribbon imbedded in a plastic rod which was installed between two sections of heat exchanger tubing. Thermocouples located under the ribbon were used to determine point temperatures around the surface of the tube. The heat generated in the ribbon was removed by air, the shell-side coolant. From the point temperatures and the power input to the ribbon, local heat transfer coefficients were calculated. The exchanger had a 6-inch diameter shell and 1-inch diameter tubes. No tube-side fluid was used in the above method.

Local heat transfer coefficients were determined along the length of the exchanger for each tube in the bundle for a constant mass flow rate. Two tube arrangements and five baffle spacings were investigated. Average shell-side Nusselt numbers obtained for the model heat exchanger for various baffle spacings agreed with those of other investigators. The average shell-side Nusselt numbers for the exchanger increased with the addition of baffles. The heat transfer area for the larger tube pitch (fewer tubes in the shell) was more effective than that for the smaller tube pitch. This result was explained on the basis of the mechanism of flow around the tubes. For the large tube pitch, the turbulent wake behind the lead tube influenced the down-stream tubes to a greater extent than in the case of the smaller tube pitch.

Other investigators have visually detected three different flow zones in heat exchangers: longitudinal flow zone, cross flow zone, and eddy flow zone. These zones were detected in the present work, and the heat transfer rates associated with each were evaluated. These results showed that the heat transfer rates in each were approximately the same.

Variation of heat transfer rates around tubes and along the length of the tube were demonstrated for all the tubes in the tube bank. The variation of heat transfer rate around tubes in cross flow was about twofold. The manner of variation was considerably different from that found on a single cylinder in cross flow. The result obtained on the variation of heat transfer with heat exchanger length clearly indicated the beneficial effect of baffles in increasing the heat transfer rate. These results also qualitatively showed the effect of clearance between tube and baffle in increasing the average shell-side coefficient.

197 pages. $2.60. Mic 58-4255

THE VAPOR PHASE REACTION OF METHANOL AND ACETYLENE

(Publication No. 24,109)

Richard Calvert Harshman, Ph.D.
The Ohio State University, 1951

In recent years there has been considerable interest in the vinyl alkyl ethers, an exceptionally reactive group of compounds. They hydrolyze, polymerize, and react by addition at the double bond very readily. Since the vinyl ether can be formed from practically any compound having a free, terminal hydroxyl group, these compounds offer many possibilities as chemical intermediates and as sources of polymers of a wide variety of properties.

The basic reaction for the formation of vinyl alkyl ethers, as described by Reppe,[1] is the addition of acetylene

to an alcohol catalyzed by alkali. The reaction might be carried out with the alcohol in the liquid or the vapor phase, although the former requires the use of pressure, particularly in the case of the lower alcohols, such as methanol.

The general objective of the present work was to study the process variables involved in the catalytic vapor phase reaction of methanol and acetylene to produce methyl vinyl ether. The variables studied were: the nature of the catalyst, the life of the catalyst, reaction temperature, space velocity, and the ratio of reactants. Because of the hazards involved, the effect of elevated pressure was not investigated.

The acetylene used in the experimental work was cylinder acetylene. It was purified by scrubbing with water to remove acetone and by drying with anhydrous calcium sulfate. It was metered with an orifice-type flowmeter. It was found possible to produce an accurately metered flow of methanol vapor by pumping liquid methanol from a constant-head supply reservoir to a constant-head feed chamber by means of a variable-stroke, constant-speed bellows pump. The overflow from the feed chamber flowed to a round-bottom vaporizer, operated so that only a small portion of the heated surface was normally covered with boiling methanol. This was found to make the vaporizer largely self-regulating. For safety reasons, provisions were made for purging the entire system with nitrogen and for operating the equipment behind a safety-glass shield. An electrically heated furnace, controlled by a variable voltage transformer, gave satisfactory control of catalyst temperature. The thermocouple used for catalyst temperature measurement was placed in a thermocouple well which was located in the middle of the catalyst bed.

A procedure was developed for the analysis of methyl vinyl ether, derived from the method of Siggia.[2] This procedure was based on the hydrolysis of vinyl alkyl ethers, in the presence of acid, to form acetaldehyde and the corresponding alcohol, followed by the formation of the addition compound of acetaldehyde and sodium bisulfite. The sample was first hydrolyzed with a known quantity of sulfuric acid, and then neutral sodium sulfite was added, the loss of acetaldehyde being carefully avoided. The formation of the addition compound thus resulted in the consumption of acid. It was found to be possible to determine the consumption of acid by potentiometric titration.

Since soda lime has been reported by Reppe[1] to be a suitable catalyst and its use should assure a supply of constant activity, many of the studies of process variables were made with this catalyst. Studies were first undertaken to determine the effect of start-up procedure on catalyst activity. It was necessary to heat the catalyst to operating temperature in a stream of nitrogen, then to add methanol to the stream, and then to substitute acetylene for the nitrogen.

Studies were next undertaken on the effect of catalyst on-stream time on its activity. These studies showed no appreciable decrease in activity in 8 hours of operation at temperatures of 200° and 250° C., space velocities of 7.4 and 14.7 volumes of gaseous reactants (at S. T. P.) per volume of catalyst per minute, and molar ratios of methanol to acetylene of 2.8 and 5.7 to 1. Variations in start-up procedure, higher operating temperatures, longer on-stream time, and repeated start-ups and shut-downs were found to affect the catalyst activity. In all subsequent experiments tests were limited to 8 hours' duration, and fresh catalyst was used for each series of experiments.

Because reaction temperature is often one of the most important process variables and the optimum temperature is usually a function of the other variables, a complete temperature conversion curve was determined for each set of other conditions. In all cases these curves showed definite maxima. A typical example was that obtained with a space velocity of 4 volumes of reactants per volume of catalyst per minute and a molar ratio of methanol to acetylene of 5.7 to 1. In this instance the conversion of acetylene increased from 19 per cent at 175° C. to 24 per cent at 200° C. and decreased to 22 per cent at 225° C. and to 18.7 per cent at 250° C. Calculation of the equilibrium conversion showed a definite decrease with increasing temperature. Later material balance studies showed that the effect of competing reactions was negligible. Since the reaction to form methyl vinyl ether is exothermic and excessive temperatures decrease the conversion, it would probably be desirable in commercial practice to provide a series of reactors with intermediate cooling.

The results at different space velocities and ratios of reactants were compared at the temperature of maximum conversion for each set of conditions. In each case, the yield of product, expressed in ml. of gaseous product (at S. T. P.) per ml. of catalyst volume per minute, was determined at the temperature of maximum conversion, and this value was also used as a basis of comparison. Because of the various excesses of methanol used, these conversion calculations were based on the input acetylene. The results of these studies are summarized in Table I.

TABLE I

EFFECT OF SPACE VELOCITY AND RATIO OF REACTANTS ON CONVERSION TO, AND YIELD OF, METHYL VINYL ETHER

Space Velocity, $min.^{-1}$	Ratio MeOH: C_2H_2	Temperature of Maximum Conversion, °C.	Maximum Conversion Per Cent	Maximum Yield, $min.^{-1}$
4.0	5.7:1	200	24.1	0.145
7.4	5.7:1	210	17.8	0.198
14.7	5.7:1	230	10.7	0.232
29.4	5.7:1	230	5.5	0.244
44.1	5.7:1	225	3.1	0.201
14.7	1.5:1	165	4.8	0.283
14.7	2.8:1	200	7.3	0.284
14.7	4.2:1	210	8.7	0.246
14.7	5.7:1	225	10.7	0.233

Since lower yields require a larger reactor for a given production and lower conversions require larger equipment for removing the product from the converter exit stream to permit recycling the unreacted material, a balance between these cost factors indicates an optimum space velocity of about 15 $min.^{-1}$ and an optimum ratio of methanol to acetylene of about 4 to 1.

Since economical operation in a process requiring a high recycle rate is possible only if the amount of

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undesirable by-products formed is small, complete material balances were determined for operating conditions that the above experiments indicated to be near optimum. The components of the converter exit stream were separated by condensation and fractional distillation and analyzed for methyl vinyl ether, acetal, acetaldehyde, methanol, and acetylene. These experiments showed that acetyl and acetaldehyde were the principal by-products, and that these were equivalent to only about 1 per cent of the methyl vinyl ether produced. Within the limits of experimental error, all reacting materials were accounted for in these material balances.

Comparison of various catalysts indicated that soda lime was one of the most useful. Catalysts prepared by impregnating charcoal with potassium hydroxide had a higher initial activity but were more readily deactivated. A catalyst prepared by impregnating charcoal with sodium carbonate showed a very low initial activity. Studies of catalyst reactivation showed that temperatures up to 500° C. in the absence of air, and temperatures up to 750° C. in the presence of air, for the soda lime catalyst were not effective for catalyst reactivation. Chemical regeneration by impregnation with fresh alkali did restore the activity of the potassium hydroxide catalyst on charcoal carrier. These results indicated that catalyst deactivation was not the result of the surface absorption of a fouling agent, but was caused by a chemical reaction forming a stable, noncatalytic substance from the alkaline catalyst.

The questions arising from the present study could best be answered by experiments on a larger scale with equipment designed to permit continuous operation. For this reason, a pilot plant, to produce 100 pounds per day of methyl vinyl ether, was designed from the data obtained in the present study.

In this pilot plant design, acetylene is preheated to prevent condensation of methanol, mixed with methanol vapor, and the mixed gas stream is preheated to reaction temperature. The gases are then passed through the catalytic converter, which contains three catalyst beds separated by coolers. The catalyst beds and the coolers are contained in the same shell. Duplicate converters may be provided to allow replacement or regeneration of catalyst without interruption of operation. The converter exit gas is passed through a water-cooled condenser to condense some of the unreacted methanol. Provision is made for returning at least part of this methanol directly to the process stream. The gases then pass through a brine-cooled condenser where the remaining methanol and the product methyl vinyl ether are condensed. The uncondensed acetylene is returned to the process stream. The product and unreacted methanol may then be separated by batch distillation and the methanol recycled.

167 pages. $2.20. Mic 58-4256

1. Reppe, Julius Walter. Acetylene Chemistry. New York: Charles A. Meyers & Co., 1944.

2. Siggia, Sidney. "Determination of Vinyl Ethers and Acetals," Anal. Chem., 19 (Dec., 1947), pp. 1025–29.

Abstract published by special arrangement with The Ohio State University.

VAPOR-LIQUID EQUILIBRIA OF MULTICOMPONENT SYSTEMS

(Publication No. 24,918)

Theodore John Rigas, Ph.D.
Northwestern University, 1957

An equilibrium cell of a new design for vapor-liquid equilibrium studies has been constructed. The reliability of this cell has been tested with the binary system methane, n-butane for which experimental data are available in the literature. With this unit multicomponent systems can be investigated for pressures of 25 to 6,000 psi and temperatures ranging up to 350°F. With some changes of the mechanical components of the cell these pressure and temperature ranges can be extended.

The novel feature of this cell resides in trapping small samples of the coexisting liquid and vapor phases between two valves. These samples are then expanded and analyzed in a mass spectrometer. The volume of the equilibrium chamber can be made to vary by means of a movable piston actuated hydraulically with mercury. In addition a magnetically driven stirrer has been incorporated to facilitate the establishment of equilibrium conditions. Temperatures in the cell can be controlled within 0.5°F and pressures can be duplicated with an accuracy of 0.2 per cent. Liquid and vapor samples can be analyzed by means of a mass spectrometer within 0.005 mole fraction. With this unit, in general three hours are required for the establishment of equilibrium conditions.

Vapor-liquid equilibrium relationships have been established for the ternary system methane, propane, n-butane at 100°F. The pressures used in this investigation were confined near the critical region and made possible the establishment of the critical conditions for this system. From these studies, equilibrium constants for the individual components of this system have been developed and are presented as a function of pressure and composition for 100°F. 177 pages. $2.35. Mic 58-4357

TURBULENCE CHARACTERISTICS IN A SPIRAL GAS STREAM

(Publication No. 25,277)

William Raymond Schowalter, Ph.D.
University of Illinois, 1957

Measurements were made of the flow structure in two types of spiral flow fields. The first was a vortex tube in which air entered one end of an 8-inch pipe through a 2-x4-inch sweeping or involute entry and left at the opposite end. The second was a cyclone in which the same entry was used but the end fittings were altered so that the geometry resembled a cyclone separator. The measurements consisted of locating the mean velocity vector and finding the longitudinal and radial intensities of turbulence at several points in the flow field. The longitudinal intensity is normal to the radial intensity and is in the plane determined by the mean velocity vector and the radial intensity. The mean value of the product of the two turbulent velocities was also measured. Measurements of both the mean and the turbulent quantities were taken with a

constant-current hot-wire anemometer. Crossed-wire probes were used which were made from 0.00014-inch tungsten wire. Data were taken in the vortex tube at inlet velocities of 62, 87, and 100 ft./sec.; inlet velocities of 42, 61, and 86 ft./sec. were used in the cyclone.

The experimental results show that the shapes of the mean structure and of the turbulent structure are insensitive to changes in the flow rate but they are affected greatly by the geometry of the system.

In the vortex tube, the angular velocity is nearly constant at points less than one-half of the distance from the center line of the pipe to the wall.

Approximately 85 per cent of the axial flow in the vortex tube takes place at points greater than three-fourths of the distance from the center line of the pipe to the wall.

Secondary flow patterns exist in both the vortex tube and in the cyclone which are not symmetrical with the axis, but which extend over the entire diameter.

The tangential and axial velocity profiles are not symmetrical with the pipe axis. The asymmetry of these components can be explained by postulating a dynamic center line which has the shape of a helix.

The longitudinal intensity of turbulence increases sharply near the center of the vortex tube. This is caused primarily by the abrupt decrease in mean velocity near the center.

The radial intensity shows a similar increase near the tube center, and near the wall, it decreases rapidly with distance from the center.

The longitudinal turbulent intensity in the cyclone has the highest values near the center and near the wall. The high intensity near the wall is caused both by the decrease in mean velocity and the increase in the root-mean-square turbulent velocity. The radial intensity drops off sharply near the wall.

The effect of turbulence on the collection efficiency of cyclones is estimated to be of the same order of magnitude as the effect of secondary flow.

162 pages. $2.15. Mic 58-4258

THERMAL DIFFUSION IN NON-IDEAL GASES

(Publication No. 25,304)

James Eugene Walther, Ph.D.
University of Illinois, 1957

The effect of pressure on the thermal diffusion of binary gas mixtures has been investigated for the following gas mixtures: carbon dioxide with nitrogen, ethane, ethylene, and helium; ethylene with nitrogen, argon, and neon; nitrogen with argon; and helium with ethylene, argon, and nitrogen. The maximum pressure for most systems was 500 atmospheres, although three mixtures – carbon dioxide-nitrogen, carbon dioxide-helium, and ethylene-helium – were investigated up to 1,000 atmospheres. The effects of temperature and composition were also determined.

A two chamber cell was used in the study. The chambers were separated by a fritted glass disc across which a temperature gradient of ten degrees centigrade was maintained. The chambers contained fritted bronze discs to decrease the effect of thermal convection, and temperatures were measured by thermocouples set on the faces of the glass disc. Runs were made until the steady-state was attained. The difference in composition in the chambers was determined by thermal conductivity analysis of gas samples.

The thermal diffusion ratio is defined by the following phenomenological flux equation for a binary mixture:

$$\vec{J}_1 = \rho D \left[\overrightarrow{\text{grad}}\, x_1 - \frac{\alpha x_1 x_2}{T} \overrightarrow{\text{grad}}\, T \right]$$

where $\vec{J}_1$ = flux of mass, D = diffusion coefficient, x_i = mol fraction i, T = absolute temperature, and ρ = density. The sign of α is taken to be positive when the "heavier" component accumulates at the cold wall. In this study the "heavier" component is defined as the component with the larger attractive potential.

It was found that the thermal diffusion ratio becomes large in magnitude and negative in the critical region. For the carbon dioxide-helium system the negative minimum is 70 for the thermal diffusion ratio, which corresponds to a separation of 40 per cent. The thermal diffusion ratio increases with pressure in the low density range and then decreases to become negative in the critical region. At higher densities its magnitude becomes smaller and positive for most cases. An increase in concentration of the "heavier" component increases the magnitude of the effect. For a system at a temperature far above the critical region temperatures the effect of pressure is small.

The Enskog dense gas theory applied to thermal diffusion does not predict either the magnitude or the sign of the thermal diffusion ratio except at very low densities.

The thermodynamics of irreversible processes indicates from the data that the net heat of transport of the molecule with the larger attractive potential is large and negative in the critical region. There exists no consistent kinetic interpretation for this quantity for dense gases.

The coefficients of diffusion, viscosity, and thermal conductivity of dense gases can be predicted reasonably well from Enskog's dense gas theory. They do not provide any sensitive test for a new theory. The thermal diffusion ratio changes both magnitude and sign in the critical region and therefore provides a most sensitive test for any new dense gas theory. 90 pages. $2.00. Mic 58-4259

ENGINEERING, CIVIL

THE MECHANICS OF OVERLAND FLOW

(Publication No. 25,367)

Charles Edward Behlke, Ph.D.
Stanford University, 1957

Spatially variable laminar flow due to the effect of rainfall upon a smooth plane is considered for the study.

The following assumptions are made. The shear stress produced by the plane upon the moving sheet of water is the same as that for uniform, steady, laminar flow of the same depth. The slope of the plane is small. The momentum and kinetic energy correction factors are unity. The flow is everywhere disturbed, laminar flow. The plane of

overland flow is infinite in the downstream direction so end conditions in this direction are neglected.

The equation of motion is solved simultaneously with the continuity equation and the total derivative equations for the depth and velocity of flow. Since there are no downstream end conditions to be considered, these partial differential equations are reduced to ordinary differential equations which define characteristic curves. The differential equations for the characteristic curves are solved to obtain the velocity and depth of flow along the plane.

Three aspects of the hydrograph are considered. They are the rising limb, the transition from steady flow to the unsteady flow recession hydrograph following the cessation of rainfall, and the recession hydrograph. Each of these is developed analytically by the method of characteristics or variations of it.

The laboratory work consists of a few complete rising, transition, and recession hydrographs for a 30 foot overland flow plane upon which simulated rainfall has been introduced. The analysis is compared with the laboratory results and it is compared with several hydrographs taken on test plots by the U. S. Soil Conservation Service in the early 1940's.

The laboratory results indicate that for short planes and rainfall intensities of up to four inches per hour, the assumption regarding the shear stress between the plane and the sheet of water is good. For longer lengths of overland flow a shear stress correction factor ranging up to 2.0 is required. Where the length of overland flow and the rainfall intensity is very large, turbulent flow exists which is beyond the scope of the analysis. Such flow is not considered.

The laboratory results also indicate that for small rain rainfall intensities and very small slopes of the plane the end conditions materially effect the upper end of the rising limb of the hydrograph as well as the transition, but they have no effect on the falling limb of the hydrograph.

54 pages. $2.00. Mic 58-4260

BLAST LOADING ON SINGLE-STORY INDUSTRIAL-TYPE STRUCTURES

(Publication No. 25,223)

John David Haltiwanger, Ph.D.
University of Illinois, 1957

The loads produced on single-story, industrial-type structures by atomic blasts were studied by means of experimental and analytical methods. Two structural types were considered; one was sensitive primarily to drag loading and the other was sensitive to diffraction as well as drag.

The drag-sensitive structures had a steel frame and both the walls and roof were covered with frangible siding which was blown off very early in the loading history. The other type had the same frame and roofing but had walls of reinforced concrete with 30 percent window openings.

These two types of structures were tested in full scale under normally incident shock waves from an actual atomic explosion. In these tests, measurements of resistance, pressure, and transient response were taken which were subsequently studied analytically to obtain the drag and diffraction loading characteristics of each type. These data were also studied to check the reliability of presently available approximate methods for predicting the dynamic response of simple structures to blast loads. In all of the analytical studies, as well as in the approximate prediction methods, the test structures were idealized as equivalent single-degree-of-freedom systems.

Small-scale models of the test structures were tested in a shock tube under shocks comparable to those experienced by the prototypes in the field. These models were tested under both normally incident and oblique shocks and transient pressure and response data were obtained. The data obtained from the normally incident shocks were studies analytically as were the data from the field tests to determine the drag and diffraction loading characteristics of the models. The loading characteristics of the models were found to differ significantly from those of the prototypes.

The oblique loading model tests were carried out to study the effects of orientation on the normal components of load transmitted to the structures. The angle of orientation was varied from zero degrees, or normal incidence, to a value of sixty degrees. The response of the models in a direction normal to their longitudinal axes was measured under each oblique shock and from these response measurements were computed the normally applied loads.

The loading characteristics of these structures under normal as well as oblique incidence were found to differ in many respects from those determined experimentally by other investigators. These differences can be attributed in general to the fact that the structures tested were, geometrically, rather complex, whereas the prior tests were made on relatively simple geometric solids for which the effects of shielding of some structural elements by others were either non-existant or more easily defined.

133 pages. $2.00. Mic 58-4261

STRESSES IN LAYERED TWO-DIMENSIONAL ELASTIC SOLIDS

(Publication No. 25,239)

Meyer Marshall Lemcoe, Ph.D.
University of Illinois, 1957

The dissertation was carried out with two objectives in mind: (1) to develop the general expressions for the horizontal, vertical, and shearing stresses in layered elastic solids which satisfy the conditions of plane strain; and (2) to evaluate, numerically, the stresses for a broad range of the elastic and geometric parameters of the system, in order to provide information pertinent to the rational analysis of load bearing layered systems subjected to a line or strip loading.

To illustrate the method, the investigation was carried out for a two-layer system in which each layer was considered to be of infinite extent in the horizontal direction, and, in the vertical direction, the upper layer was considered of finite depth and the lower layer of infinite depth. It should be noted that the techniques developed are by no means restricted to two-layer systems, the extension to the three and four-layer systems being straight forward.

To determine the extent to which the amount of friction

at the interface affects the stress distribution through the various layers, two limiting conditions at the interface were investigated (1) Smooth Case: the two layers are everywhere in contact at the interface, on which the shearing resistance is fully developed so that the two layers act together as a composite elastic medium, with fully continuity of displacements across the interface, (2) Smooth Interface: the two layers are everywhere in contact at a frictionless interface, resulting in continuity of the displacements across the interface in the vertical direction only.

The numerical solutions for the two-layer cases were carried out for a value of Poisson's ratio equal to one-quarter, a value which more closely approximates that of most engineering materials than the limiting values of zero and one-half used primarily for convenience by many of the earlier investigators in determining the expressions for stresses and displacements in radially symmetric problems. Any arbitrary values (0 to 1/2) of Poisson's ratio could have been used in view of the generality of the methods which have been developed.

Twelve distinct physical problems, covering a fairly broad range in the numerical values of the pertinent geometric and elastic parameters, were solved. The two-layer system is essentially a two parameter problem, expressible in terms of the ratio of the width of the loading to the depth of the upper layer, and the ratio of Young's modulus of Elasticity in one layer to that in the other layer. Stresses were evaluated at 16 points along the upper surface, interface, and other pertinent locations. Stresses at other points are obtainable from the constants to the displacement functions which were computed and summarized in tabular form. From plots of the final stresses, stresses may be obtained for intermediate numerical values of the loading, geometric, and elastic parameters.

Certain other special problems, including the problem of an elastic solid resting on a rigid base, were solved.

All stresses were obtained for a unit line or strip load applied vertically at the top surface.

The general expressions developed may be used to calculate the stresses in the supporting layered media for embankments, continuous footings, pavement systems, compressor-station foundation mats, canals, etc., if the supporting media can be represented as a two-layer plane strain system. 134 pages. $2.00. Mic 58-4262

STRENGTH IN SHEAR OF PRESTRESSED CONCRETE BEAMS WITHOUT WEB REINFORCEMENT

(Publication No. 25,287)

Mete Avni Sozen, Ph.D.
University of Illinois, 1957

OUTLINE OF INVESTIGATION

The primary object of this investigation was to obtain a better understanding of the behavior of prestressed concrete beams without web reinforcement. Tests of 43 rectangular beams and 56 I-beams are described in this report. The concrete strength, f'_c, varied from 1750 to 8560 psi, and the reinforcement ratio, p, from 0.0010 to 0.0096. The range of prestress was from zero to 140,000 psi. Beams were tested with shear spans ranging from 2 ft to 4 ft 6 in. All beams had overall cross-sectional dimensions of 6 by 12 in. The I-beams had web thicknesses of 1 3/4 in. or 3 in.

Each beam was loaded to failure within four to six hours. Records of load, deflection, concrete strains at the top, steel strain, and crack pattern were obtained throughout all stages of loading.

Results of the tests indicated that web reinforcement would be a very desirable element in prestressed concrete beams as it is in reinforced concrete beams. Studies of the data resulted in an empirical expression for the inclined tension cracking load and a hypothesis of shear-compression failures.

BEHAVIOR OF TEST BEAMS

Of the 99 beams tested, 90 failed in shear and 9 in flexure. The beams exhibited distinctly different characteristics of behavior only after the formation of inclined tension cracks. Up to this level of loading, the response of the beams to load was essentially similar.

The few beams which did not develop critical inclined cracks failed in flexure by crushing of the concrete or fracture of the steel. Those that did develop inclined cracks failed in shear as a result of redistributions of stress caused by these cracks. Shear failures were classified into two categories: (1) shear-compression, and (2) web distress. Shear-compression failures were similar to flexural compressive failures, except that the concrete crushed at the upper end of the inclined crack where there was a very high strain concentration. This mode of shear failure was observed in both rectangular and I-beams. Web distress represented three different mechanisms of destruction of the web: (1) Secondary inclined tension cracks formed near the supports and above mid-height of the beam and separated the compression flange from the web, leading to a violent failure. (2) Inclined cracks near the loading points extended horizontally toward the supports tending to separate the web from the bottom flange entirely. (3) The web crushed under high compressive stresses due to arch action created by the loss of shear flow between the steel and the compression flange. Web distress prevailed in I-beams with thin webs and high prestress forces.

In general, shear failures were violent and caused complete destruction. Web distress was more violent in its symptoms than shear compression. The behavior of the beams after the development of inclined cracks was unstable.

ANALYSIS OF TEST RESULTS

An empirical expression, Eq. (6), for the inclined tension cracking load was derived from the data. The average ratio of measured to predicted inclined cracking loads for all the test beams was 1.00 and the mean deviation was 0.074. On the basis of the observed relations between concrete and steel strains at different stages of loading and the nature of the failure, an analysis for strength in shear-compression was presented which is similar to the analysis for strength in flexure except for the use of different strain compatibility factors before and after inclined tension cracking. The average ratio of measured to predicted

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loads for all the beams failing in shear-compression was 1.01 and the mean deviation was 0.065.

In general, it was concluded that the useful ultimate strength of prestressed concrete beams without web reinforcement should be limited to the inclined cracking load unless positive measures are taken to prevent web distress. 172 pages. $2.25. Mic 58-4263

DYNAMIC BEHAVIOR OF SIMPLE SPAN HIGHWAY BRIDGES TRAVERSED BY TWO-AXLE VEHICLES

(Publication No. 25,305)

Robert Kuo-liang Wen, Ph.D.
University of Illinois, 1957

An analytical study is made of the dynamic behavior of simple span highway bridges under the passage of heavy vehicles. The investigation involves (a) the development and analysis of a mathematical model representing the physical system; (b) the preparation of a program for obtaining numerical results on the ILLIAC, the high speed digital computer of the University of Illinois; and (c) the study of the effects of certain factors that enter into the problem.

The mathematical model considered consists of a simply supported beam traversed by a number of two-axle loads with a constant velocity. A typical two-axle load consists of a sprung mass supported on two springs in parallel, with each spring connected to an unsprung mass. The general approach used in analyzing the model is similar to that used in previous investigations concerned with the effects of a single-axle load as reported by Hillerborg, and Tung, Goodman, Chen, and Newmark. In this investigation, as in the previous studies, it has been assumed that the dynamic deflection configuration of the beam is proportional to some static deflection function. In the previous studies, only the effect of the weight of the moving axle was considered in computing the static deflection function, whereas in the present investigation the influence of the weight of the beam itself was considered in addition to that of the two-axle load.

The ILLIAC program prepared can handle various combinations of the parameters defining the system, such as the ratio of the spacing of the axles to the length of the beam, and the ratios of the mass of the different elements of the load unit to that of the beam. It is also capable of solving problems involving an uneven roadway surface.

The factors investigated in this study are considered in two groups. The first group includes the effect of vehicle speed, of axle spacing, and of the initial oscillation of the bridge; these studies are for a smooth and level deck surface and for a vehicle which has no vertical or angular oscillation as it enters the bridge. The second group includes the effect of waviness of the bridge deck, and of the initial vertical or angular oscillation of the vehicle. The bridges considered in this study are typical I-beam bridges. The two-axle load used corresponds to the two heavy rear axles of an H20-S16 vehicle.

The results obtained for the first group of problems show increasing dynamic effects with decreasing span length of the bridge – a trend similar to that given by the current AASHO Specifications. The maximum amplification factors for maximum bending moment at mid-span are found to be equal to 1.72, 1.42, and 1.40 for the 20 ft., 45 ft., and 70 ft. spans, respectively. The results indicate further that a synchronization of the period of vibration of the bridge with the time interval between the successive applications of the axle loads does increase the dynamic effects in the bridge. It is also shown that the waviness of the deck surface and the initial vibration of the vehicle may be sources of appreciable dynamic effects in simple span highway bridge. 125 pages. $2.00. Mic 58-4264

THE INELASTIC BEHAVIOR OF BEAM-COLUMNS SUBJECTED TO TIME DEPENDENT LOADS

(Publication No. 25,312)

Raymond Frank Wojcieszak, Ph.D.
University of Illinois, 1957

The major purposes of the investigation described in this dissertation were, (1), to determine experimentally the resistance of several beam and beam-column specimens to inelastic deformations applied slowly and rapidly, (2), to correlate, if possible, these resistances with the static and dynamic properties of the materials from which these specimens were made, and (3), to develop approximate procedures by means of which the time and the rate of general yielding dependence of mild steel could be considered in the single-degree-of-freedom representations of the specimen systems.

The results obtained indicate that, beyond the static elastic limit, the resistance of a mild steel beam or beam-column to a lateral displacement produced rapidly is greater than that corresponding to the same lateral displacement produced slowly; the increase in the resistance of a beam or beam-column can be explained, within experimental error, by consideration of the experimentally determined dynamic properties of the specimen material which includes delayed yielding and rate of yielding behavior typical of mild steel; and that the theoretical response of a mild steel structure, which is represented as a single-degree-of-freedom system, can be computed with a fair degree of accuracy if the effects of time and general yielding are considered. 124 pages. $2.00. Mic 58-4265

ENGINEERING, ELECTRICAL

ON THE USE OF DELAY LINES AS NETWORK ELEMENTS

(Publication No. 25,370)

Lewis Embree Franks, Ph.D.
Stanford University, 1957

This study concerns the development of analysis and synthesis techniques for networks containing idealized distributed-constant elements in addition to the usual set of lumped-constant elements having parameters R, L,

and C. The idealized distributed element is taken to be a lossless delay line represented by the parameters R_o and T. R_o is the characteristic resistance and T is the electrical length in terms of the time delay between terminal pairs of the delay-line element. Networks consisting of delay lines and lumped elements are called line-lumped networks.

Analysis procedures are directed toward finding transfer functions for a network containing an arbitrary interconnection of delay lines and lumped elements. Some matrix methods for finding these transfer functions are presented. The transfer functions are not rational in the complex frequency variable and the usual procedures for transient analysis are not applicable. A method for transient analysis based on the time-series representation is presented. A particularly useful form of the time-series representation is the z-transform, a familiar mathematical tool for the analysis of sampled-data systems.

An examination of the time-domain and frequency-domain response properties of line-lumped networks reveals some characteristics remarkably different from the responses of lumped-element networks. These characteristics are used to advantage in the development of synthesis procedures for approximating a prescribed impulse response by z-transform methods. The z-transform methods are particularly applicable to numerically prescribed data. Special emphasis is given to synthesis of networks having impulse responses of limited time duration. 131 pages. $2.00. Mic 58-4266

THIN WIRE LOOP AND THIN BICONICAL ANTENNAS IN FINITE SPHERICAL MEDIA

(Publication No. 25,331)

Julius Herman, Ph.D.
University of Maryland, 1957

Supervisor: Dr. Henry R. Reed

The problem of radiation from a thin wire loop antenna in air and with a finite spherical core of material other than air has been solved quite rigorously. The equations for the fields have been expressed in general spherical wave functions, or modes. It has been found that three families of waves are present, one transverse electric and two transverse magnetic. The solution holds for any size loop, for any frequency, and for any core material, including air, whose characteristics are homogeneous and isotropic. Losses in the core are incorporated in the solution provided the volume current effect is negligible relative to the conduction current effect of the antenna. Expressions have been derived in mode series for the input impedance, radiated power, and efficiency of radiation.

An experimental check of the theory has been performed using a solid ball about three inches in diameter fabricated from a ferrite with known electromagnetic characteristics. The wire antenna was a thin silvered loop flush with the surface of the ball. Input impedance was measured over a frequency range of 90 to 250 megacycles. The results yielded good agreement with theoretically calculated values.

As predicted, the use of a ferrite core effectively increases the electrical size of both loop and thin biconical antennas. An impedance transformation results, especially useful for physically small radiators. For the same applied voltage, the core antenna radiates much more power than the air antenna of the same dimensions. The radiated power would be enormously greater except for the losses in the solid core. As lower loss materials are developed, the use of this type of radiator and receiver of energy should be notably advantageous.

103 pages. $2.00. Mic 58-4267

A GUN AND FOCUSING SYSTEM FOR CROSSED-FIELD TRAVELING-WAVE TUBES

(Publication No. 25,376)

Orion Lindel Hoch, Ph.D.
Stanford University, 1957

The results of a project involving the design and the experimental evaluation of a gun and focusing system for crossed-field traveling-wave tubes are presented. One of the problems encountered in the design of crossed-field traveling-wave tubes (particularly M-type amplifiers or backward-wave oscillators) is a limitation on current due to the restricted cathode size in the usual gun systems. The scheme considered here attempts to incorporate into a crossed-field device the techniques commonly used in O-type devices for designing converging Pierce-type strip-beam guns, which can increase the effective cathode area, say ten times. A design procedure is presented for getting a well-formed beam from such a gun which is magnetically shielded through a fringing crossed-field region into the uniform-field region of interaction.

An analysis of electron flow through the fringing-field region, including the effect of space charge, is presented. A trajectory equation, solved on a digital computer, yields trajectories for the beam and design curves for various values of the important parameters. The results show the scheme to be feasible.

Results are also presented from tests on an experimental, demountable tube used to test the focusing scheme. About 90-95% of the current entering the crossed-field region could be focused to the collector, and the system behaved generally as the design predicted. An evaluation of the experimental data showed the scheme to be useful.

87 pages. $2.00. Mic 58-4268

ON THE PROPERTIES OF MATCHED FILTERS

(Publication No. 25,380)

Dean Winton Lytle, Ph.D.
Stanford University, 1957

Matched filters are defined and their properties as optimum signal detectors discussed. The conditions under which matched filters are realizable are enumerated. The conditions for realizability are not unduly restrictive and a variety of synthesis methods are applicable. The method

providing greatest flexibility and adaptability is the synthesis procedure which employs tapped delay lines. This mode of synthesis is based upon the sampling theorem of frequency limited time functions.

Of the communication systems in which matched filters may be utilized, an important class consists of those systems in which the transmitted signal may be specified by the system designer. In these systems an advantageous selection of signals is possible. That is, of the infinity of signals within a prescribed bandwidth and time duration, a small number prove optimum in the sense of yielding good matched filter output shapes concomitant with reasonable matched signal configurations. In order to measure quantitatively the quality of the input and output signal shapes, two measures are defined; the effective bandwidth W_e, and the effective time duration T_e. These measures combined in a product yield a dimensionless measure of the matched signal quality. Binary matched signals, offering good W_e and excellent T_e, are studied at length.

Two novel methods of synthesizing matched filters are investigated. These types, termed multiple bandpass and all-pass inverse-matched filters, may be employed when the matched signal is prescribed. The latter type is shown to be inferior to the tapped-delay-line matched filter due to its low effective-time-duration matched signal. The multiple bandpass inverse-matched filter may have a large T_e matched signal but does not present the flexibility or ease of synthesis offered by tapped delay lines.

195 pages. $2.55. Mic 58-4269

ANALYSIS OF MAGNETRON OSCILLATIONS AT LOW MAGNETIC AND ELECTRIC FIELDS

(Publication No. 24,074)

John Lewis Moll, Ph.D.
The Ohio State University, 1952

A study was made of the properties of multi-cavity magnetrons operating at the lowest possible magnetic fields and voltage.[1] The operation is best described in terms of the characteristic magnetic field and voltage, which are defined as

$$eV_o = \frac{1}{2}\, m\, r_a^2 \left(\frac{2\omega}{N}\right)^2 \qquad (1)$$

$$\frac{2\omega}{N} = \frac{B_o e}{2m}\left(1 - \frac{r_c^2}{r_a^2}\right) \qquad (2)$$

where e = electronic charge
m = electronic mass
r_a = anode radius
r_c = cathode radius
N = number of anode segments
ω = angular frequency of oscillation
V_o = characteristic voltage
B_o = characteristic magnetic field

The characteristic voltage V_o has the physical significance of being the voltage through which an electron must fall to gain velocity equal to that of a traveling component of the first space harmonic of the rf field at the anode. The characteristic magnetic field produces theoretical cut-off at the characteristic voltage. It is believed that a multi-cavity magnetron cannot oscillate at voltage below the characteristic voltage. (It is assumed that the electronic interaction is with the first space harmonic.)

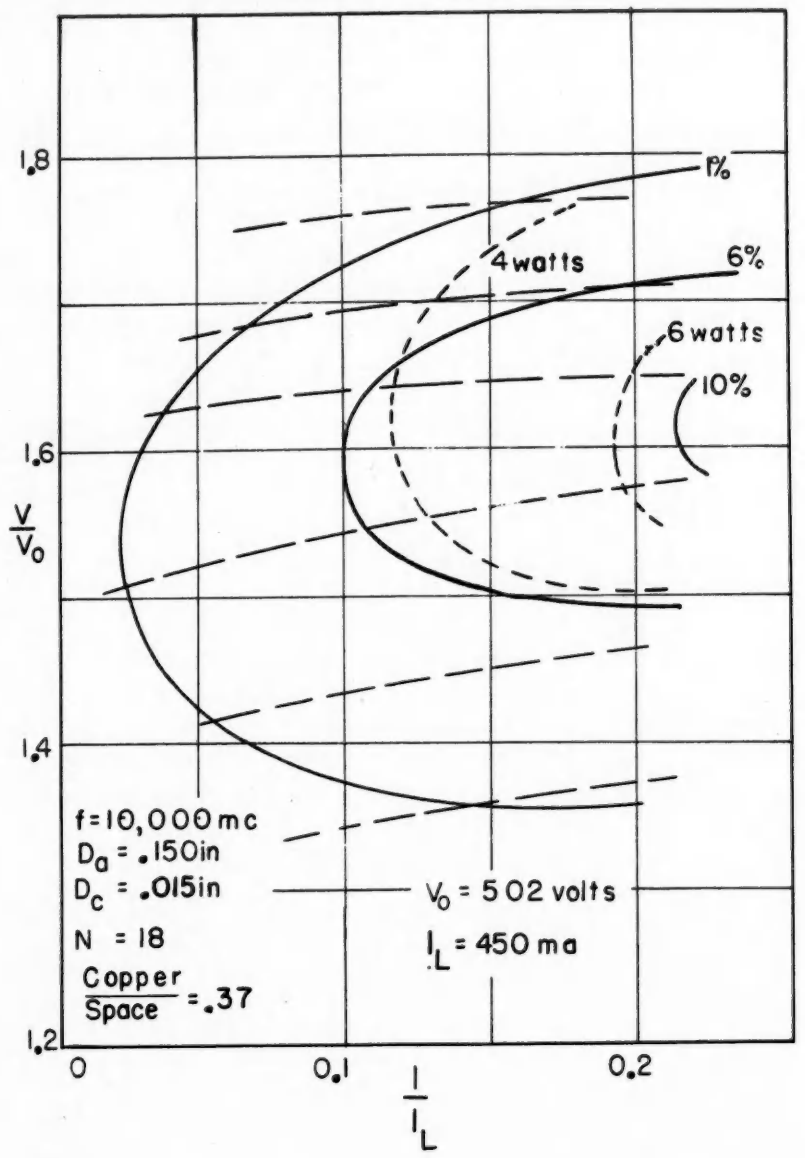


Figure 1

Normalized performance chart for low field magnetron.

In order to operate at voltages and magnetic field slightly greater than the characteristic values, it is necessary to use a cathode radius smaller than for normal type operation. For an 18 vane magnetron, ratios of r_c/r_a of 0.1 to 0.2 give optimum electronic interaction as compared to 0.633 for the normal type of operation at voltage and field several times the characteristic values. Figure 1 shows a typical normalized performance chart for a magnetron designed to operate at low fields. The ratio copper/space is the ratio of the thickness of the copper anode segments to the gaps between the segments. The current is expressed in units of the Langmuir current I_L, which is defined as the space-charge-limited current that would be conducted if the characteristic voltage V_o were applied to the magnetron anode in the absence of magnetic field. In all of the experimental models built, maximum efficiency occurred at currents of approximately 0.2 of the Langmuir current.

Figure 2 shows a typical region of oscillation in relation to the Hartree voltage and the Hull cut-off voltage. Also plotted is the maximum over-all efficiency at each magnetic field for the particular oscillator. The electronic efficiency is approximately twice the over-all efficiency since the resonator was critically coupled to the

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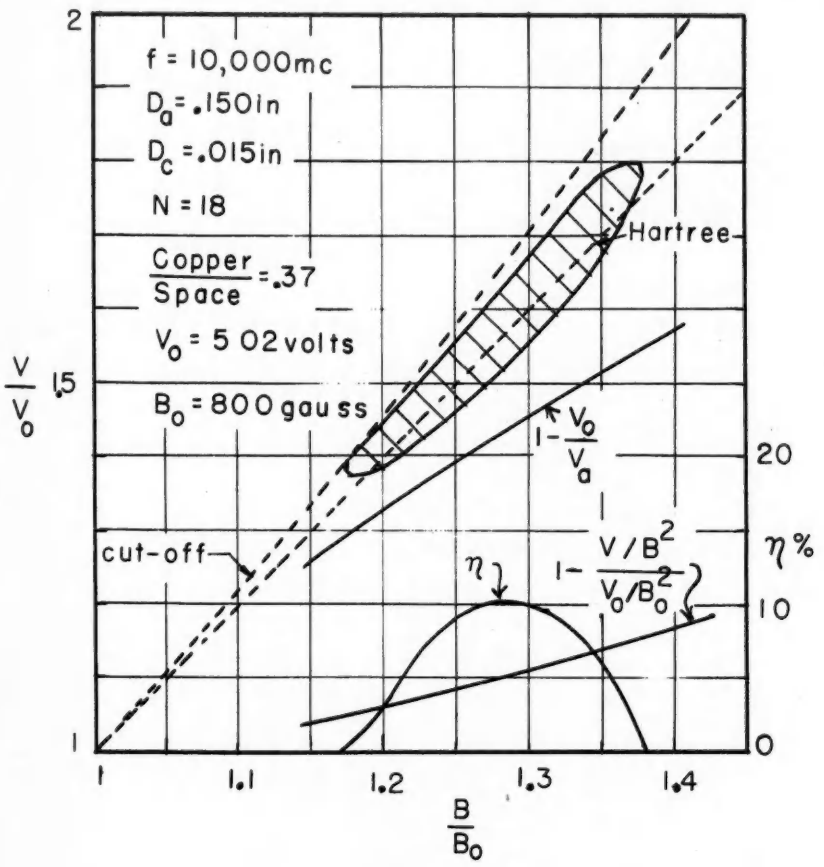


Figure 2

Region of oscillation and maximum over-all efficiency η. The electronic efficiency is approximately twice the over-all efficiency.

guide and the oscillator delivered maximum power into a matched line as determined from Rieke diagrams. If it is assumed that the electrons are slowed down to the wave velocity when they strike the anode, the electronic efficiency is

$$\eta_e = 1 - \frac{V_o}{V_a} \qquad (3)$$

where η_e = electronic efficiency
V_a = anode voltage

Another formula for electronic efficiency which holds approximately for magnetrons designed to operate in the normal manner with voltage and field several times the characteristic values is[2]

$$\eta_e = 1 - \frac{V/B^2}{V_o/B_o^2} \qquad (4)$$

These two curves are plotted in Figure 2. It is seen that the maximum electronic efficiency at $B/B_o = 1.28$ is comparable to the value given by equation (3).

An effort was made to operate a low-field magnetron at 3000 volts by scaling the wave length but keeping the interaction space geometry constant. It was observed that the cut-off was critically dependent on cathode centering at voltages above 1000 volts. Also, the maximum intensity of oscillation occurred when the cut-off was sharpest. The violation of Hull cut-off[3] is a serious limitation on the voltage at which low field magnetrons can be designed to operate.

It is well known that if an electron stream and electromagnetic wave are traveling at very nearly the same velocity, there will be an exchange of energy. If the electron

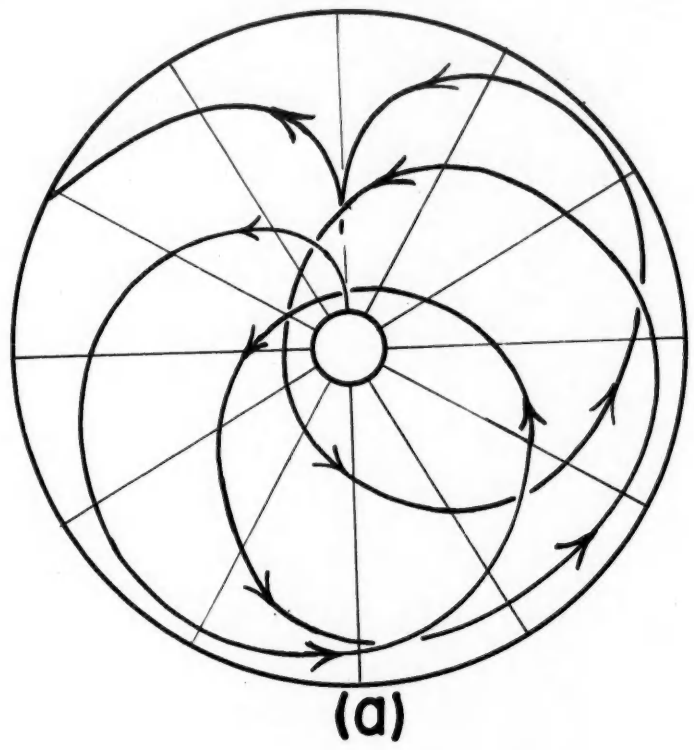


Figure 3(a)

Electron trajectory for $B/B_0 = 1.25$, $\frac{\max E_{ac}}{E_{dc}} = .05$, $\alpha = 0$

stream is traveling slightly faster than the wave, energy is delivered to the electromagnetic wave. This situation is obtained in the low field magnetron. The static electron trajectories very nearly fill the cathode-anode space and, because of the small cathode, have very nearly constant angular velocities. The angular velocity of the electron is proportional to the magnetic field. This explains the finite

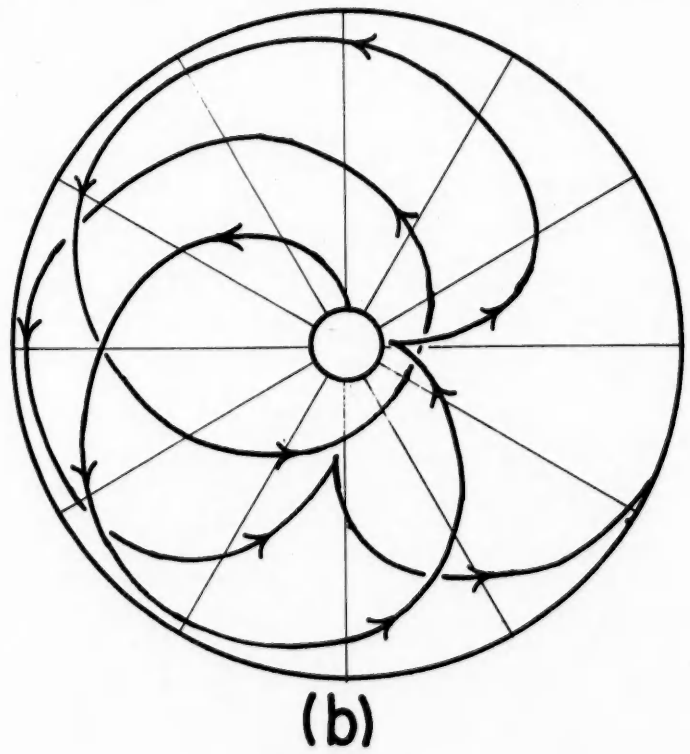


Figure 3 (b)

Electron trajectory for $B/B_0 = 1.25$, $\frac{\max E_{ac}}{E_{dc}} = .05$, $\alpha = \frac{2\pi}{3}$.

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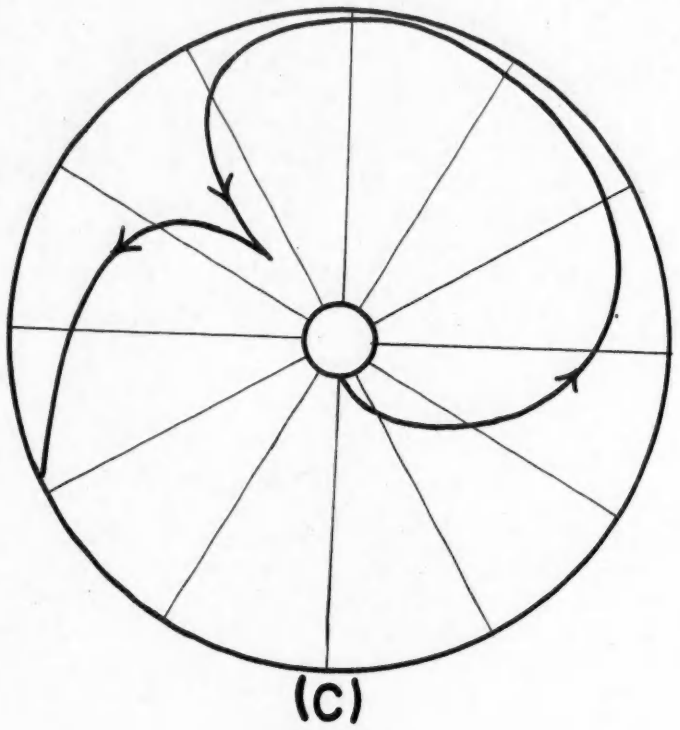


Figure 3 (c)

Electron trajectory for $B/B_0 = 1.25$,

$$\frac{\max E_{ac}}{E_{dc}} = .05, \qquad \alpha = \frac{4\pi}{3}$$

region of oscillation. If the magnetic field is made too large, the difference in electron and wave velocities is so great that there is no exchange in energy.

For the cylindrical geometry with small cathode, the potential including space charge effects is very nearly linear. A single rotating wave was assumed, and electron trajectories were calculated using a REAC analogue computer. Values of B/B_o were taken from 1.1 to 1.34. There was qualitative agreement between the calculation and the experimental results.

Figure 3 shows typical electron trajectories for different phase angles α of the rf field. The ratio of the maximum gradient of the rf wave to the dc gradient is $\frac{\max E_{ac}}{E_{dc}}$. It was assumed that the anode voltage was 99 per cent of the cut-off voltage. The theoretical calculation and experimental results support the physical picture of electrons traveling at very nearly the wave velocity, delivering energy to the wave.

Conclusions:

Because of the relatively low density of power dissipated on the electrodes, the multi-cavity magnetron operating at low magnetic fields and voltage has very good possibilities for operation at millimeter wave lengths. The effect of increasing the number of anode segments should be investigated. Also, an attempt should be made to find the largest cathode diameter consistent with good low field operation. A better understanding of violation of the Hull cut-off condition is needed to understand the limitation on voltage at which it is possible to operate low field magnetrons. 113 pages. $2.00. Mic 58-4270

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2. Slater, J. C. Microwave Electronics, New York: D. Van Nostrand Co., 1950, p. 310.

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THE ROLE OF IONOSPHERIC-LAYER TILTS IN LONG-RANGE HIGH-FREQUENCY RADIO PROPAGATION

(Publication No. 25,393)

Sidney Stein, Ph.D.
Stanford University, 1957

An introduction to the role of ionospheric-layer tilts in long-range h-f and vhf radio propagation is given. Tilts in the reflecting layers can have a first-order effect on radio propagation as a consequence of the curvilinear geometry of the earth. Low-angle rays reflected from a properly oriented, sufficiently tilted F layer will propagate beyond the bulge of the earth and illuminate the ionosphere again. When sufficient ion density exists at the second illuminated region, the rays will propagate on around the earth. A ray may be reflected several times before striking a properly oriented tilt so that the surface of the earth is illuminated. These modes are called ^nF modes where n is the number of layer reflections.

Ray trajectories for a simple ionospheric model have been computed as an example of "tilted reflection." Anticipated fading, MUF, and field-strength characteristics of ^nF modes are discussed. The build-up of ^nF backscatter echoes is not linked to the characteristics of thick-layer reflection and is explained in terms of "geometrical" time-delay focusing.

Supporting backscatter observations at Stanford may be summarized as follows. On each frequency of observation (30, 17 and 12 Mc) many different ^nF (and combinations of conventional and ^nF) modes have been observed. The characteristic ranges on the different frequencies are, to first order, the same. ^nF backscatter echoes are often of high amplitude relative to 2F backscatter. At times, a complete absence of intervening ground backscatter between ground-zero and ^2F, ^3F, or ^4F echoes is observed. The times of occurrence of ^nF modes, length of each individual occurrence, direction of occurrence, and combinations of different modes are fundamentally related to the structure of the F layer and the radio frequency of observation. In addition, "E-scatter" and reflection off the top of the E layer are very noticeably associated with F-layer tilts.

An ionospheric mode that has been an important contributor to auroral reflections registered at Stanford depends upon the existence of tilts in the F layer to the north. Long-range auroral reflections, hitherto attributed to prevalent, strongly reflecting auroral structures situated between 300 and 1200 km above the surface of the earth, are explained on the basis of E-region ionization observed via reflection from a tilted F layer. An explicit distinction has been made between this type of reflection and newer classes of radio reflections observed at high and middle latitudes arising from field-aligned ionization in the E and F regions.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

A considerable amount of the difficulty experienced in determining the correct mode of propagation of auroral echoes may be removed by a new approach. Conventional h-f radars are normally intended for line-of-sight detection of auroral ionization. However, paths involving ionospheric reflection may also be used for radar surveillance. Radar surveillance of auroral ionization that utilized one or a combination of ionospheric paths is called the "aurorasonde" technique; it represents an extension of the sweep-frequency backscatter technique.

99 pages. $2.00. Mic 58-4271

REFLECTION AND TRANSMISSION AT A SHARPLY-BOUNDED IONOSPHERE

(Publication No. 25,400)

Irving Wollin Yabroff, Ph.D.
Stanford University, 1957

Experimental evidence indicates the ionosphere can be treated as sharply-bounded for radio waves incident from below at frequencies less than 200 kc. Equations are derived in this report for the calculation of reflection coefficients and characteristics of the waves excited within the ionosphere such as the direction of phase and energy propagation, phase velocity and attenuation rate. These equations are valid at all frequencies and any arbitrary angle of incidence.

A complete set of curves is shown for an isotropic medium and some curves are shown for an ionosphere with the earth's magnetic field included. At very low frequencies, it is shown that the reflection coefficients are independent of azimuthal angle of incidence, to a first approximation.

The "quasi-longitudinal" approximation, which is often used at very low frequencies, is shown to give reflection coefficients which are accurate to within ten percent when the plasma frequency is larger than twenty times the wave frequency. However, the calculated wave normal and ray directions within the ionosphere are very much in error when this approximation is used.

The case of incidence from within the ionosphere is treated and a sample calculation is shown.

77 pages. $2.00. Mic 58-4272

ENGINEERING, MECHANICAL

A METHOD FOR DETECTING CHEMILUMINESCENT RADIATION IN AN INTERNAL COMBUSTION ENGINE, AND TEST RESULTS FOR ISOOCTANE

(Publication No. 25,143)

Robert Thurton Corry, Ph.D.
Columbia University, 1957

The overall heat losses in internal combustion engines have been investigated extensively, but little effort has been expended on measurements of the mechanisms involved. This dissertation deals with the relative importance of thermal radiation and chemiluminescent radiation in the heat loss from the combustion products in the combustion chamber. The intensity of thermal radiation is dependent only on the temperature, pressure, composition, and dimensions of the radiating gas, while chemiluminescent radiation occurs virtually simultaneously with the combustion reactions, and is proportional to the rate of combustion. This distinction is the basis of a method for experimentally determining their relative importance.

In this experimental method the combustion rate is varied while the parameters which control thermal radiation are kept as nearly constant as practical. This is done by varying the engine's speed while keeping the air and fuel consumptions per cycle constant. Ignition timing is advanced appropriately with increasing engine speed. In practice it was found that the indicated pressures throughout combustion, expansion, and exhaust increased with increasing engine speed. This is an indication of increased gas temperatures, with a corresponding increase in thermal gas radiation. The observed increase in radiation intensity with increased engine speed (and combustion rate) is due to the combined effects of increased thermal radiation and any chemiluminescence accompanying the additional heat-release. A procedure for estimating the increase in thermal radiation on the basis of published data is given; considerable extrapolation is needed to do this, with the possibility of appreciable error. It is believed, however, that the absolute error involved in this procedure is less than could occur if the published data were extrapolated to compute the total thermal radiation rather than merely the change in it. After an allowance has been made for the increase in thermal radiation, any residual increase is attributable to chemiluminescence.

The above method has been applied to an engine operating on isooctane (2,2,4-trimethylpentane) as a fuel, with an air-fuel ratio of 12:1. The compression ratio was about 4.6. The throttle setting was such that the volumetric efficiency was 58 percent, referred to 68°F and standard atmospheric pressure. Runs were made at 1660 and 3000 revolutions per minute with good reproducibility. The radiant energy from a small solid angle incident on a fluorite window in the wall of the engine's combustion chamber was measured by a calibrated thermoelectric detector. The average intensity of the radiation was found to be about 16 1/2 percent greater at the high speed than at the low speed. The background radiation from the far wall, and the thermal gas radiation were each estimated to be about 11 percent greater at the high speed. The background radiation was computed from a wall surface temperature obtained by extrapolation from thermocouple temperature measurements in the wall. The higher gas pressures and temperatures during exhaust blow-down and during the exhaust stroke contributed significantly to the computed increase in thermal gas radiation at the high speed. It was concluded that chemiluminescence was of minor importance under the conditions of the test, since the amount of chemiluminescence accompanying an 80 percent increase in heat-release rate is computed as only about 5 percent of the radiation observed at the low heat-release rate.

The instrumentation for air and fuel measurement, the radiation detector and associated optical system, and the use of the balanced-pressure diaphraghm indicator are

described. The mounting of the engine window eliminated clamping of the window between gaskets, and a novel protective shutter was provided to isolate the window from the sooting effect of the combustion-chamber gases when it was not actually in use for a radiation measurement.

189 pages. $2.50. Mic 58-4273

ENGINEERING, MECHANICS

ELASTIC-PLASTIC BEAM DYNAMICS BY THE METHOD OF CHARACTERISTICS

(Publication No. 23,421)

Roy Carl Alverson, Ph.D.
Brown University, 1957

The work described in this report is a numerical study of the plastic deformation that occurs in a beam of uniform cross-section and finite length when it is subjected to dynamic loads of high intensity. The analysis is based on a moment-curvature relation which includes elastic vibrations and ignores the effects of strain hardening. The effect of shear force on the plastic yielding of the beam and the effects of rate of strain are neglected.

The numerical method which is presented is based on the integration of the full equations of motion by the method of characteristics. In this method the plasticity condition can be satisfied at an arbitrary finite number of cross-sections of the beam. The method is readily programmed for use on a digital computer and the numerical work has been carried out on the I.B.M. Card Programmed Calculator at Brown University.

Numerical results are presented for the case when a free-free beam traveling with initial transverse velocity V_o is brought to rest at the midsection over a finite interval of time. The calculated plastic deformations are contrasted with experimental results and with previous theoretical results which were obtained by a rigid-plastic type of analysis. It is found that all of the discrepancy between the deformations calculated by a rigid-plastic type of analysis and those measured in experiment should not be attributed to the effects of rate of strain and strain hardening but that some of this difference is due to the reversals of curvature that occur in the interior of the beam. It is also shown that plastic action may be intermittent at some cross-sections of the beam even under dynamic loads of low intensity, and that an elastic-plastic type of analysis will grossly underestimate the magnitudes of the plastic deformations unless this effect is included.

107 pages. $2.00. Mic 58-4274

ANALYTICAL AND EXPERIMENTAL DETERMINATION OF BUCKLING LOADS OF WOOD COLUMNS BY THE TANGENT MODULUS (ENGESSER) THEORY

(Publication No. 25,200)

Edward Ford Byars, Ph.D.
University of Illinois, 1957

The purpose of this paper was to verify the tangent modulus (Engesser) theory for intermediate length wood columns and to investigate the use of the theory for evaluating the effect of imperfections on wood columns. Toward this end several sizes and species of wood columns were investigated.

The most ideal material, clear Birch, was used first to verify the theory. Two inch square cross sections of this material were tested as columns, and the results were in good agreement with Engesser theory predictions made from compressive stress strain curves of the same material. Clear Birch was also used to evaluate the effect of moisture content on the columns by the same theory. The theory proved to be a useful tool for this purpose.

For larger columns 4 inch by 4 inch clear Douglas Fir was tested as columns, and the results compared with Engesser theory predictions obtained from compressive stress strain curves. There was good correlation between the theory and the predictions. Douglas Fir of the same size with knots as the imperfection to be evaluated was also tested as columns and compared with theory predictions. It was found that the effect of the knots could be satisfactorily evaluated from the stress strain relationship using the Engesser theory.

For investigating still larger columns, the Forest Products Laboratory made available 159 unpublished stress strain data for Yellow Pine and Douglas Fir compression specimens 12 inches by 12 inches by 4 inches. From these data column load predictions were made for various slenderness ratio values and compared with the results of column tests reported in the Forest Products Laboratory Technical Bulletin No. 167. The correlations in these cases were only fair. The reason for lack of better correlation was thought to be the fact that the compression stress strain specimens were too long and could not be considered true compression blocks. This would cause some bending stress which would lower the predictions.

110 pages. $2.00. Mic 58-4275

AN ANALYSIS OF CYCLIC STRESS BEHAVIOR FOR CONDITIONS OF CONTROLLED STRAIN

(Publication No. 25,256)

JoDean Morrow, Ph.D.
University of Illinois, 1957

The problem of the significance of residual stress in fatigue is attacked by making an analogy between residual stress and the average or mean stress in an axial fatigue test. This analogy seems warranted since both residual stress and the mean stress in an axial fatigue test represent the average stress about which the alternating stress is superimposed. Many of the experimental and analytical

difficulties usually associated with this problem are avoided through the use of this analogy.

The fundamental cause of changes in mean stress in an axial fatigue test in which the mean strain and amplitude of alternating strain are held constant is found to be the accumulation of microstrain due to repeated loading. Analytical relationships for the decay or change of mean stress under conditions of controlled strain are developed with the aid of an assumed stress-strain relation. The plastic microstrain per cycle may be expressed in terms of the assumed stress-strain relation and the conditions of loading. This expression is then integrated to give an expression for mean stress at any number of cycles.

Certain properties of the assumed stress-strain relation are determined from axial fatigue tests of SAE 4340 steel under conditions of controlled strain. Three levels of hardness of the material (Rockwell C 30, 40, 50) and eleven values of initial mean stress are investigated. In all, tests of 137 specimens are reported with mean stress measured as a function of the number of cycles. Fatigue data similar to conventional S-N plots are obtained for each of the eleven sets of specimens.

The mean stress, up to one million cycles, can be predicted within ± 10 percent by the analysis which is derived as explained above. The analysis indicates and the tests substantiate that mean stress decays more rapidly in a soft material than a hard material for the same conditions of testing.

After a million cycles, a few specimens which are subjected to small amplitudes of alternating stress continue to lose mean stress. The analysis, as presented in this thesis, does not predict this type of behavior. This phenomenon is left to future study and investigation.

It is shown experimentally that the fatigue limit of the steel in the hard condition (50 Rockwell C) is changed appreciably by mean stress. A small effect of mean stress on the fatigue limit is noted for the soft condition (30 Rockwell C). Only a small part of the difference in fatigue behavior between steels in the soft and hard conditions is attributable to the observed differences in the cyclic stress behavior. Although there is sizeable loss of mean stress for large amplitudes of alternating stress in the soft condition compared to the hard condition, there is little loss of mean stress in either the soft or hard condition for alternating stresses near the fatigue limit.

By analogy of mean stress to residual stress, it is possible to make the following conclusions concerning the importance of residual stresses in fatigue:

A. Residual stress is particularly important in hard steels.
B. For large amplitudes of alternating stress, residual stress does not remain constant during fatigue loading.
C. The change which occurs in the residual stress due to fatigue loading does not affect the fatigue limit appreciably, but may have an effect on the fatigue life for large amplitudes of alternating stress.

103 pages. $2.00. Mic 58-4276

LARGE (SECOND ORDER) TORSION OF ELASTIC BARS

(Publication No. 25,390)

Winfred Aldridge Shaw, Ph.D.
Stanford University, 1957

Rivlin has shown, both theoretically and experimentally, that circular bars of incompressible neo-Hookean (rubber like) material will (1) elongate and (2) become less stiff under large twist. Earlier, Poynting had performed experiments on steel and brass wires (Hookean materials) and found an elongation.

Weber, in a less rigorous theoretical analysis, had predicted much earlier that bars of Hookean material would (1) contract and (2) become stiffer under large twist. Evaldson has found good agreement, experimentally, with Weber, for the torque-twist relation of thin rectangular steel strips.

The apparent conflicts are resolved for a Hookean material. A pure torque, in addition to an axial force, is applied to a bar of doubly symmetric cross-section. The form the displacement functions take when expanded in a power series in the angle of twist is logically deduced and the equations of equilibrium formulated. These equations are then specialized for a bar of elliptical cross-section in the strained state. The displacement functions are taken to the third power in the angle of twist and the stress and strain components determined to this degree of accuracy.

Torque-twist experiments were performed on thin rectangular steel strips.

Good agreement, for an elastic Hookean material, was obtained with the Weber conclusions for axial contraction and stiffening. 126 pages. $2.00. Mic 58-4277

A NUMERICAL SOLUTION FOR PLATE BENDING PROBLEMS

(Publication No. 25,398)

John Denison Wood, Ph.D.
Stanford University, 1957

Various approximate methods of analysis have been developed for the flexure plate problem to obtain a practicable solution. The dissertation discusses an engineering approximation to the flexure plate problem which may be used by practicing design engineers. The method of solution is based upon the bending of a lattice.

The lattice is formed from an array of intersecting beams which are arranged in a definite pattern. The flexure of the plate is preserved if the solid medium is replaced by a lattice containing elastic beams of infinitesimal size. Theoretically, the size of the lattice segment must be infinitesimal to imitate the behavior of the continuous material. Such a framework would be difficult to solve. For practical engineering results, the size of the segment is taken fairly large. The moments of inertia of the lattice beams are functions of the moment of inertia of the plate. The application of loads to the lattice is restricted to the segmental joints. The boundary conditions of the lattice only approximately satisfy the boundary

conditions of the prototype. The approximations, methods of solution, and interpretation of such a lattice are the main subjects of the dissertation.

Some of the simplifying assumptions in the analysis of the lattice which are used in the dissertation are;

1. Square lattice segments are used. Hence, the lattice analogy is applicable to rectangular plate problems.
2. Poisson's ratio is, $\gamma = 1/3$.
3. The lattice beams are continuous through intersection points. Reservations to this assumption are made when using approximate operators for analysis.
4. The deflections of the lattice beams at intersection points are made compatible.
5. Slope compatibility of the lattice beams at intersection points occurs incidentally. It may be due to beam continuity or to assumed edge conditions.

A relaxation method of analyzing the flexural lattice by using imaginary supports is presented in the dissertation. An alternative method of analyzing the lattice, by iteration, is also presented.

A section of the lattice along a line of segmental joints is examined. The equilibrating moments required at each joint along this line are distributed over their adjacent segment widths. These distributed moments provide approximate bending and twisting moments per unit length for the same line on the plate prototype.

The results of the dissertation provided;

1. A simple approximate solution for some plate problems of structural engineering interest, such as the corner canopy and the plate containing a free square hole.
2. A favorable comparison of results for the same plate problem by the lattice analogy and by a solution from the theory of elasticity.
3. A physical picture of plate behavior by using the lattice analogy.

157 pages. $2.10. Mic 58-4278

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

FRENCH EIGHTEENTH CENTURY DRAWINGS: STUDIES IN THEORY AND PRACTICE

(Publication No. 23,813)

Hereward Lester Cooke, Jr., Ph.D.
Princeton University, 1956

In every period of art history there have been sets of rules, dogmas and conventions. Sometimes they were codified into academic laws sanctioned by official approval: more often, however, they consisted of tacitly understood conventions which artists regarded as their stock in trade. Usually they evolved so slowly that few contemporaries were aware of their existence or would have thought it necessary to comment on such obvious and universally accepted artistic laws. It is only when the rules of a given period have been lost and supplanted by another set of conventions that the art historian, left only with the work of art as evidence, begins to realize how powerfully persuasive and essential for an understanding of the art of a period these dogmas were.

The late seventeenth and early eighteenth centuries provide a clear example of the type of conventionalized artistic order. The accumulation of artistic traditions inherited from the Renaissance and Baroque periods crystalized during this time into a series of hard and fast rules which an artist might add to or deviate from, but which he would never think of questioning. The purpose of this study is to try to separate and analyse the various theories which constituted the framework on which artists of the late Baroque period in France constructed their works of art. The source material has been for the most part the hand-books and technical manuals intended for use by artists, which were published in considerable numbers during this period. A secondary source has been the more general theoretical writings of philosophers and critics. The material used to illustrate these theories has been chosen for the most part from drawing collections, since the theoretical basis for drawings has scarcely been considered heretofore by writers on art and secondly because the operation of a theory can often be studied more readily in drawings rather than in other art forms.

The chapters have been divided as follows: first, the philosophy of eclecticism with an attempt to determine which artists from previous periods were the most generally approved models for painters to copy and imitate. Secondly, the theories about the functions of the imagination. Third, the theories concerning the unknowable element in art--the Je ne sais quoi. Fourth, the theories concerning the use of light to control the spectator's attention. Fifth, the various applications of the theory of aerial perspective. Sixth, the theories concerning touche, the brushwork of the painter. Seventh, theories concerning the use of contrast, and eighth the theories regarding the use of different types of contours.

Many of these theories originated during the Renaissance rather than the Baroque period. However, in the course of artistic theory and criticism since the Renaissance there never has been a consistent effort to analyse the actual application of these ideas of art, and it is hoped that the present study, dealing principally with their application to drawings, will in some way fill in this gap in the history of art.

350 pages. $4.50. Mic 58-4279

THE METABOLISM OF TRANS FATTY ACIDS

(Publication No. 25,234)

Patricia Veitch Johnston, Ph.D.
University of Illinois, 1957

The metabolism of trans fatty acids was studied and the results discussed from the point of view of a possible relationship between dietary trans fatty acids and atherosclerosis. An initial experiment was carried out to determine the efficiency of metabolism of the trans isomers from different fat sources. Thirty female albino rats were divided into six groups and were fed a basal synthetic diet plus 10 percent of the various triglycerides for 16 days. Trielaidin, glyceryl trans 8-trioctadecenoate, and margarine stock were used as sources of trans fatty acids and trilaurin, triolein and olive oil were used as trans free dietary fat. Further experiments were designed to determine: 1) whether a relatively constant or maximum level of trans acids was deposited in rat tissues when their intake was kept constant, 2) if the trans fatty acids which were deposited in the carcass fat disappeared when trans acids were removed from the diet, 3) whether trans fatty acids were transmitted from mother to young. Margarine stock which contained 40 percent trans acids provided the source of trans fatty acids for the latter experiments. Human tissue were also examined for the presence of trans fatty acids. Infra red spectrophotometric analysis was used to determine quantitatively the amount of trans double bond fatty acids in the fat.

The rat organism was found to be capable of efficiently metabolizing trans fatty acids from glyceryl trans

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8-trioctadecenoate, trielaidin, and margarine stock. Trans fatty acids were not found to be present in rat tissues or feces unless they had been fed in the diet.

When margarine stock was fed to rats at a constant level, the percentage of the carcass fatty acids existing in the trans configuration reached a maximum level, and this level was unaltered provided that the intake of trans acids remained unaltered. The inclusion of a soft fat in the diet facilitated the absorption of the trans fatty acids from margarine stock. If the trans isomers were removed from the diet, they gradually decreased in amount in the tissues but did not completely disappear after two months on a trans-free diet.

The trans isomers did not appear to inhibit the growth rate of rats or to cause any obvious deleterious effects.

Only traces of trans acids were passed on by a mother rat to her young, but the amount of trans isomers in the carcass fat of the young was markedly increased when they were allowed to suckle the maternal milk.

Autopsy and biopsy material from human subjects was examined for the presence of trans fatty acids. All the samples of human fat examined contained some trans fatty acids and the amount varied from 2.3 to 14.4 percent trans in the extracted fat.

The results were discussed from the point of view of a possible relationship between dietary trans acids and atherosclerosis. If trans fatty acids in the diet contribute to the onset of degenerative diseases such as atherosclerosis, the latter did not occur because of an inability of the animal organism to metabolize trans acids. However, the effect of the deposited trans acids on other metabolites is as yet unknown and before the hypothesis of possible harmful effects of trans isomers is considered completely unfounded, further investigations into the effect of trans isomers on other metabolites, such as the phospholipids, cholesterol esters and lipoproteins, would appear essential. 60 pages. $2.00. Mic 58-4280

STUDIES ON THE GERMINATION CHARACTERISTICS OF SPORES OF BACILLUS STEAROTHERMOPHILUS

(Publication No. 25,298)

Dudley Seymour Titus, Ph.D.
University of Illinois, 1957

The object of this study was to determine the germination characteristics of spores of Bacillus stearothermophilus.

Methods of production and cleaning of spore suspensions are described. Sporulation was increased by adding 10 p.p.m. manganese to the sporulation medium. The spores were freed of vegetative cells by treatment with lysozyme.

Germination was measured by staining, loss of refractility, and loss of heat resistance. The correlation between the results obtained by staining and loss of refractility was good. The correlation between the loss of refractility and the loss of heat resistance was high, but not as high as that between the staining and loss of refractility methods.

Preliminary germination studies showed that L-histidine, casein hydrolysate, and glucose were the only compounds tested which stimulated germination. Stimulation by glucose was considerably less than that by histidine or casein hydrolysate. It was necessary to heat activate the spores in the presence of the substrate in order to induce germination.

Phosphate completely inhibited the action of histidine at pH 6.8. No inhibition by phosphate was observed with histidine at pH 5.0.

Both histidine and casein hydrolysate were more effective at pH 5.0 than at pH 7.0. Some germination occurred after heat activation of spores buffered at pH 5.0. The amount and rate of germination in buffered solutions was considerably less than that which occurred in histidine solutions. Both the amount and rate of germination increased with increasing histidine concentrations up to a level of about 10 μM/ml. Higher concentrations did not effect the results appreciably. Urocanic acid was as effective as histidine in stimulating germination, but carnosine was without effect.

Viable plate counts of heat activated spores averaged about thirty per cent of the direct microscopic count. Heat activation in the presence of low concentrations of histidine at pH 6.5 increased the per cent recovered to about sixty per cent. It was hypothesized that the spores were in three different states of activation: active spores, dormant spores, and inactive spores. The active spores germinated in a complete medium, the dormant spores could be activated by heat, and at least part of the inactive spores could be activated by heating in the presence of histidine at pH 6.5.

Ninety four per cent of the direct count of one suspension could be recovered in viable counts. It was also found that these spores would germinate in distilled water after heat activation. An effect of histidine on these spores was demonstrated by showing that germination proceeded slowly in the presence of histidine without heat activation. It was hypothesized that these spores had inadvertently been produced in a low concentration of manganese.

A spore suspension which was known to have been produced without the addition of manganese to the medium also germinated slowly in distilled water after heat activation, although not as completely as did the spores from the suspension described above. An analysis of the manganese content of these suspensions indicated the manganese content was lower than that of a suspension produced in the presence of 10 p.p.m. manganese.

It was suggested that dipicolinic acid (DPA) formed a metal-linked complex in the spore which blocked germination, and that manganese formed a particularly stable linkage with DPA. Heat activation in the presence of histidine allowed the spores to germinate when placed in a nutritionally complete medium. When the pH of the heating medium was reduced to 5.0, the complex was less stable, and the spores germinated without the addition of nutrients. A mineral analysis and viable counts of the spores suggested that the mineral balance was more important than the manganese content.

92 pages. $2.00. Mic 58-4281

A GEOGRAPHIC ANALYSIS OF THE DEVELOPMENT POTENTIAL OF RANTOUL, ILLINOIS

(Publication No. 25,261)

Allen George Noble, Ph.D.
University of Illinois, 1957

The study of the development potential of Rantoul is an attempt to set a pattern for investigations of individual locations from which broad concepts of industrial and urban location can be drawn. The major purpose of the study is to investigate the possibilities of industrialization as the most likely possibility to produce a local economy less vulnerable to fluctuations of individual factors. The study has an immediate practical application and thus is an opportunity to verify in a specific situation whether or not geographic methods of inquiry can be applied to shed light on the solution of public and/or private problems.

If Rantoul performed only the trade function, it should have a population of 1000-1500 maximum, according to the central places theory of urban location. However, Rantoul performs an additional function--education. As a result, the village has a population considerably higher.

About 7% of the population of Rantoul is economically supported by the town's inherent trade advantages; the other 93% depend upon Chanute AFB for its livelihood. The support which the Base provides to the community is investigated in detail.

The several urban phenomena and patterns which are of special importance because they reveal the urban environment in which industrial development must take place, are examined. Among these are land use, land valuation, housing and zoning.

Most of the urban places in the region surrounding Rantoul possess a few manufacturing plants although some cities have large concentrations of industries. The industrial geography of the region is revealed by the pattern of production workers, value added by manufacture, and number of manufacturing establishments. However, these basic patterns do not accurately reveal the reasons behind the choice of specific plant locations. Further, the actual pattern of manufacturing is not identical with the optimum location pattern. A scientific analysis of the factors of industrial location reveals the divergence of the two patterns.

Several methods exist for the scientific study of industrial location. The geography of cost approach has received no definitive test of its usefulness in studying the potential of particular communities. It is used in this study.

The cost of assembling production materials is the first major cost area influencing industrial locations. Rantoul has an industrial location advantage when production materials are assembled from any of nine single territories or combinations of territories. In six other cases Rantoul is at a disadvantage.

Examining the costs of fuels, power, and water conjointly, the poor competitive position of Rantoul is emphasized. The cost of fuels and power in Rantoul is high compared with other cities selected for study. Water costs are moderate in Rantoul, although many other cities offer water at lower rates. Because of the desirable quantity and quality of its water supply, the Village is better able to compete with other communities on the basis of water than on fuel and/or power costs.

Rantoul has a general disadvantage in competition with other communities as regards labor costs and a distinct advantage for labor skills and characteristics. Furthermore, a local labor supply exists sufficient to support initial industrial development.

The various influences of taxes, climate, and site considerations are treated as the final components of the second area of industrial location costs, production expenses.

Marketing products is the final major cost and is treated by reference to four principal types of markets. The national industrial market is concentrated in the Official Freight Territory to which 15 cities out of 60 have a cost advantage over Rantoul. Eight cities have comparable costs and 36 have a cost disadvantage. The principle of centrality dictates that marketing costs to the entire national consumer market and to the local or regional consumer and industrial markets, largely concentrated in Chicago, St. Louis, and Indianapolis, will be lowest from Rantoul and cities nearby.

569 pages. $7.25. Mic 58-4282

A METHOD FOR INVESTIGATING THE EFFECTS OF TOURISM ON THE FUNCTIONAL AND MORPHOLOGICAL DEVELOPMENT OF A CITY: AS APPLIED TO GREATER VICTORIA, BRITISH COLUMBIA

(Publication No. 24,920)

Malcolm Emerson Robinson, Ph.D.
Northwestern University, 1957

The method presented in this study involves an analysis of the relation of tourism to the historical development, location, social character, economic base and internal distribution of activities of a city. The combined results of such a method of analysis is a more complete understanding of the relation of tourism to the development of a city. The application of this method of study to a number of cities may make possible the discovery of some general principles concerning tourism and urban development. The development of such a method is necessary because tourism has become an increasingly important activity. Yet, its impact on cities is complex.

Victoria, British Columbia was chosen for the study because it has an important tourist trade, although it is not primarily a tourist center, and more adequate statistics

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are available concerning the tourist traffic in this city than are generally available. The study indicates that the rise of tourism in Victoria is an outcome of the city's past history. The city failed to develop as a trade and manufacturing center, but did through the years prove to be attractive to the tourist. As a result, public and private interests invested in facilities to increase the city's acceptability as a tourist center.

The study also indicates that the rise of tourism in the city is related to the city's site, situation and regional setting. The combination of negative locational characteristics for the development of trade and manufacturing and positive locational characteristics for the development of tourism were found to provide a partial explanation for the development of the city as a tourist center.

The study further indicates that the types of tourists who come to the city are related to the city's development as a tourist center. The "Victorian" character of the city's atmosphere and the fact that most of the city's tourist attractions are things to be seen has attracted only a few types of tourists to the city.

The study also indicates that the tourist trade is a basic activity of the city. The tourist trade is about as important a source of external income as one of the city's industries. This trade appears to have little direct relationship to the other basic and non-basic activities of the city. Only about four percent of the labor force in the non-basic activities of the city are directly related economically to the tourist trade.

Finally, the study indicates that the distribution of some activities in Victoria is related to the function of the city as a tourist center. Two specialized tourist shopping sections have developed along principal commercial streets. The tourist ferry docks, souvenir shops, antique shops, apparel stores, motels and tourist homes appear to be at their present location because of the tourist trade. There appears to be little relation between the location of restaurants, food stores, gasoline stations and other activities and the tourist trade. The location of the city's industrial activities detracts from the city's tourist appeal. Thus, by applying the method outlined, it was found possible to distinguish the dominant features of the city's development as a tourist center.

221pages. $2.90. Mic 58-4283

A GEOGRAPHIC STUDY OF THE TACONITE INDUSTRY OF NORTHEASTERN MINNESOTA

(Publication No. 25,311)

Frederick Theodore Witzig, Ph.D.
University of Illinois, 1957

Heavy demands for steel during the second world war and the postwar expansion period made serious inroads into the reserves of high grade merchantable iron ore in northeastern Minnesota. This rapid decline in high grade reserves stimulated the research that finally resulted in acceptable methods of processing and agglomerating the vast reserves of the low grade iron ore called taconite on the Mesabi range. The purpose of this study was to examine the nature and processes of the taconite industry, to measure the influence of the developments of this new industry on the established mining patterns of the Minnesota iron ranges, and to evaluate the social, economic, and geographic implications for northeastern Minnesota.

In order to evaluate and interpret the alterations in the geography of northeastern Minnesota resulting from this new emphasis on lean iron ores, the prevailing natural and cultural patterns of the Mesabi range were studied in some detail. Population, transportation, and mineral property patterns as they had evolved throughout the history of mining activity on the Mesabi were reviewed in order to provide the background for the more complete study and appraisal of the new taconite industry.

Beneficiation of low grade iron ore on the Mesabi is not a new practice. The concentration of lean ores actually began as early as 1907. However, these early processes were directed toward the concentration of hematite ores which were found principally on the central and western sections of the Mesabi range. Continued research ultimately led to an economical method of concentrating and agglomerating the vast tonnages of low grade magnetite iron ore (taconite) on the east Mesabi range, a segment of the Mesabi which had previously seen little activity. Several preliminary plants were built in the late 1940's and two large scale commercial installations are now operating in northeastern Minnesota.

A study of the mining and processing procedures of the taconite industry was made to determine the differences and similarities between this new kind of effort and the former mining and processing patterns. It was discovered that the requirements of this new indistry are considerably different from those of the regular mining activity. Significant increases in the water, power, transportation, and labor requirements are necessary for the profitable operation of the taconite plant. In order to meet these new requirements, significant changes in the geography of northeastern Minnesota have already occurred and will continue to do so as the industry expands.

Two major modifications in the geography of northeastern Minnesota brought about by the utilization of taconite have been the migration of mining activity to the East Mesabi and the migration of beneficiating activity to the Lake Superior shore. On the Mesabi, taconite exploitation has not only meant an extension of mining to a new geographic segment of the range but has also resulted in the expansion of older mining towns in this region and the establishment of at least two completely new urban centers in what was formerly a remote forested section of the Mesabi iron range. The construction of the processing and agglomerating center at Silver Bay along the Lake Superior shore represents a major modification in the mineral geography of northeastern Minnesota for this is the first time that any ore processing function has been carried on beyond the iron range.

Northeastern Minnesota is in a state of transition. Older mining and processing procedures are given way to the new methods required in developing low grade ores. The technological changes are in turn resulting in significant modifications in the geography of northeastern Minnesota. 218 pages. $2.85. Mic 58-4284

SOME GEOMETRICAL CHARACTERISTICS OF EARTHQUAKE MECHANISM AS INDICATED BY AN ANALYSIS OF THE S-WAVE

(Publication No. 25,111)

William Mansfield Adams, Ph.D.
St. Louis University, 1957

The purpose of this dissertation is to determine from the seismograms of a tectonic earthquake the line of the motion which generates the observed S-waves. The theory of the pattern of S-wave vibrations due to a faulting mechanism is developed and explained. By noting certain geometrical relationships between the mechanism and the emitted S-waves, a method is theoretically derived which permits the determination of the line of the generating motion from observations of the generated S-waves. A practical procedure corresponding to the theory of the method is then devised. This procedure is applied to the data collected from the original seismograms of four earthquakes as recorded at seismic observatories throughout the world.

The results of the application of the proposed method of S-wave analysis should theoretically be able to determine which of the two solutions given by the P-wave method of analyzing the tectonic mechanism of earthquakes is the correct solution. The present work finds such poor agreement between the S-wave results and the previous P-wave solutions that it is necessary to conclude that one or more of the following must be true: either the assumption that for every earthquake the phase identified as S wave from the particle motion diagram corresponds to the first P-wave motion is wrong; the P-wave method is incorrect or inadequate; the S-wave method is incorrect or inadequate.

While the first condition is a possibility, it is opposed by much contrary evidence so for the present it is not considered as probable, only possible. To select between the other two conditions necessitates a discussion of the relative merits, defects, and potentialities of the two methods.

The P-wave method is defective in several aspects; first, because of the inductive procedure involved; second, because of the lack of a criterion to ascertain that the observed earthquake has the assumed mechanism; and third, the inherent impossibility of stating which of the two nodal circles actually represents the fault plane. At present it is only applicable to earthquakes having a magnitude greater than 6 1/2. Despite all these difficulties, it is apparently useful in practice.

The S-wave method is based on a deductive theory; because of this it must be considered to have the greater potentialities. The present investigation has definitely shown that the S-wave may be detected on seismograms by the use of the synthesized particle motion diagrams. The coherency of the S-wave results definitely shows that consistency in S-wave data does exist and therefore the S-wave can be profitably investigated experimentally. The theory of the proposed S-wave method of analyzing the mechanism of tectonic earthquakes has pointed out some geometrical relationships between the recorded S-wave vibration and the faulting mechanism which permit the determination of the line of the faulting motion at the focus of the earthquake. Such information should permit the choice of the correct solution from the two P-wave solutions. Further, although previous studies of initial direction of motion have indiscriminately used velocity data with an acceleration theory, a criterion has been developed herein which permits the use of S-wave velocity data with the acceleration theory. Finally, the proposed method of using S-wave data is sufficiently analytical that a standard deviation may be determined for the result -- a considerable advantage over the P-wave method. The major defect of the S-wave method is the assumption that the ratio of SV/SH does not vary during transmission of the vibration along the ray path. This problem deserves future study.

150 pages. $2.00. Mic 58-4285

GLACIAL GEOLOGY OF GEAUGA COUNTY, OHIO

(Publication No. 25,190)

Jack Baker, Ph.D.
University of Illinois, 1957

Geauga County, in the northeast corner of Ohio, is in the Glaciated Allegheny Plateau Province. The county has been covered many times during the Pleistocene epoch by continental glaciers moving out of the Lake Erie Basin. Evidence that Nebraskan and Kansan glaciers covered northeast Ohio is indirect and based on drainage changes. Illinoian drift is rarely exposed at the surface and has been identified only in a cut bank of Swine Creek and subsurface in Griswold Creek.

Wisconsin drift of Tazewell and Cary age is within Geauga County. Most of the Tazewell till has been removed by erosion and has been identified only in low, protected areas. Early Cary till, composed primarily of sand, silt, and pebbles, crops out mostly in the south central part of the county but has been identified in other areas beneath a cover of clay till of variable thickness. The Kent moraine, a mixture of kames and knobs of sandy till, has its northern-most expression in south central Geauga County.

Late Cary till, composed primarily of silt and clay with a lower percentage of sand and pebbles, covers most of Geauga County not covered by early Cary drift. Ice advanced from the Lake Erie Basin in two lobes, the Cuyahoga lobe in the west and the Grand River lobe in the east, which meet in Montville Township. The Defiance moraine crosses the northwest half and the eastern edge of Geauga County. The moraine of the Cuyahoga lobe was constructed by an advance of the late Cary ice. The moraine of the Grand River lobe was inherited from a pre-late Cary

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structure. Size analyses and field evidence indicate that the late Cary till was deposited by at least three separate advances of the ice.

A complex network of buried valleys exists in Geauga County, the two most important being beneath the Cuyahoga River and beneath the Grand River.

118 pages. $2.00. Mic 58-4286

CHERT NODULES IN CARBONATE ROCKS OF ILLINOIS

(Publication No. 25,194)

Donald Lee Biggs, Ph.D.
University of Illinois, 1957

Seventy-eight samples of nodular chert from eighteen Illinois limestone and dolomite formations, ranging from Cambrian through Mississippian age, were investigated to determine the petrography and mode of origin of the nodules. A similarity in mode of occurrence and principal textural characteristics was noted between the nodules regardless of geologic age or type of host rock. The cherts are dominantly microcrystalline quartz with a lesser amount of fibrous quartz. No opal or hydrated silica was detected. Most chert specimens contain residual masses of their host rock.

Field relationships of the chert and host rock and a variety of thin section evidences of replacement led to the conclusion that the chert nodules are epigenetic concretions formed during diagenesis by metasomatic processes involving the aggregation of silica which was originally deposited with and dispersed through the host rocks. The scarcity of siliceous fossils in the rocks examined, the lack of any evidence of volcanism in the rocks, and large amount of dissolved silica known to be contributed to the seas as a result of subaerial weathering of land masses point to inorganically precipitated silica as the most probable source of the cherts. 97 pages. $2.00. Mic 58-4287

LOWER CRETACEOUS OF SOUTHERN ALBERTA AND ADJOINING AREAS

(Publication No. 24,904)

Rowland Perry Glaister, Ph.D.
Northwestern University, 1957

The total stratigraphic interval studied in southern Alberta and northern Montana includes all of the Lower Cretaceous strata between the sub-Cretaceous unconformity and the base of the "Fish Scale" sandstone, which occurs near the Lower Cretaceous-Upper Cretaceous boundary. Rapid facies changes in the Lower Cretaceous sediments in western Alberta necessitate using a different nomenclature in the Foothills area than in the Plains area.

In the southern Alberta Foothills the continental sediments of the Blairmore group can be divided on the basis of petrography into two distinct parts. The Lower Blairmore consists dominantly of grey shale and grey to buff protoquartzite-type sandstones and contains two members. The Cadomin member at the base of the Lower Blairmore is a persistent chert and quartzite pebble conglomerate which can be traced throughout the Alberta Foothills. The "Calcareous" member, consisting of grey to buff argillaceous limestones, calcareous shale, and buff calcareous quartzose sandstone occurs at the top of the Lower Blairmore. The Upper Blairmore sediments show a marked change in color and lithology from those below. The sediments are dominantly green, and the sandstones are usually highly feldspathic and chloritic arkosic greywackes and lithic greywackes.

The Crowsnest formation overlies the Blairmore group in the southwestern corner of Alberta and is composed of a series of tuffs, agglomerates, breccias and flows.

In the Plains area the Lower Cretaceous is divided into four major lithologic units that are, in ascending order; Mannville group, Joli Fou formation, Viking formation, and an unnamed unit above the Viking formation and below the base of the "Fish Scale" sandstone.

The Mannville group is dominantly non-marine but contains some marine strata in central Alberta. The Lower Mannville usually contains a basal quartzose sandstone member called the Cut Bank and Sunburst sandstones in southern Alberta, and the Ellerslie sandstone in central Alberta. The top of the Lower Mannville is placed at the top of the "Calcareous" member which correlates lithologically with the "Calcareous" member in the Blairmore group.

The Upper Mannville consists of kaolinitic subgreywacke-type sandstones, siltstones, shales, and thin coal beds, and is equivalent to the lower part of the Upper Blairmore to the west. In central Alberta a marine "Glauconitic" sandstone occurs near the base.

The Joli Fou formation is a marine dark grey shale body at the base of the Colorado group which loses its lithologic identity in western and southern Alberta.

The Viking formation consists of a marine succession of "salt and pepper" protoquartzites interbedded with grey siltstones and shales. In southern Alberta the Viking and Joli Fou formations are not recognizable as two distinct units and the entire succession is called the Bow Island formation, which correlates with parts of the Upper Blairmore and Crowsnest formations in the Foothills area.

An isopach map of the Lower Cretaceous indicates the Alberta Foothills was the site of a marginal basin in Lower Cretaceous time. Petrographic and lithofacies studies suggest the Lower Cretaceous sediments were mainly derived from an orogenic positive area in south-central British Columbia, with minor contributors from a mildly positive area in northern Saskatchewan and Manitoba. The lithology of the Lower Blairmore suggests a metasedimentary source area whereas the arkosic sediments of the Upper Blairmore are indicative of an igneous source. The rapid decrease in the feldspar content of the sandstones eastward, accompanied by an increase in kaolinitic clay matrix, is attributed to physical and chemical processes, and to "dilution" of the western derived sediments by clastics from an eastern source.

155 pages. $2.05. Mic 58-4288

THE GEOLOGY OF SOUTHERN HOCKING COUNTY, OHIO

(Publication No. 24,108)

John Frederick Hall, Ph.D.
The Ohio State University, 1951

INTRODUCTION

Southern Hocking County comprises an area of 186 square miles and includes the following townships: Benton, Laurel, Salt Creek, Starr, and Washington. The present study was undertaken in coöperation with the Geological Survey of Ohio for the proposed detailed mapping of the counties in southeastern Ohio.

PHYSIOGRAPHY

The southern part of the county is located in the Kanawha section of the Appalachian Plateau Province. With a maximum relief of 530 feet and a local relief ranging from 200 to 400 feet, the topography is mature. The higher hills, between 1,050 and 1,180 feet, are remnants of the Lexington-Worthington peneplane.

Streams tributary to the Scioto, Hocking, and Ohio Rivers drain the area. The Salt Creek drainage basin is the largest, and drains approximately three-fourths of the region.

GLACIAL GEOLOGY

Glacial deposits of both Illinoian and Wisconsin ages are present in the northwestern corner of Salt Creek Township. The Illinoian drift is represented by scattered erratics and the presence of till, kameterraces, and terraces along Salt Creek. The till deposits range from leached, oxidized topsoil to fresh blue-gray, unoxidized and unleached till. The average depth of leaching in the Illinoian till is about 11 feet. The terrace material is predominantly sand and gravel but includes some bodies of till.

Younger Wisconsin till is present only on the extreme western edge of Section 6, Salt Creek Township. This till is interpreted to be the Wisconsin terminal moraine. Wisconsin valley train material, leached to 3 feet in depth, is present along Salt Creek.

One notable drainage change, that of Salt Creek, caused by Illinoian ice damming, is present. Preglacially, Salt Creek flowed northeast into the old Teays River. After glaciation the stream flowed to the southwest into the present-day Scioto River.

STRATIGRAPHY

Southern Hocking County contains strata ranging in age from the Kinderhook-Osage series of the Mississippian system to the Conemaugh series of the Pennsylvanian system. The oldest outcropping unit, the Cuyahoga shale member of the Cuyahoga formation, consists of approximately 75 feet of interbedded shales and sandstones. Overlying and grading into the shale member in a facies relationship is the Black Hand member of the Cuyahoga formation, which is composed of over 175 feet of coarse-grained sandstone and lenses of conglomerate.

Disconformably above the Cuyahoga formation is the Logan formation of the Osage series. The Logan is composed of four members: the Berne, a conglomerate and coarse-grained sandstone; the Byer, a fine-grained sandstone; the Allensville, a coarse-grained sandstone; and the Vinton, a composite of fine-grained sandstone and shale. The average thickness of the Logan formation is approximately 155 feet.

The Logan formation is truncated by the disconformity which marks the boundary between the Mississippian and Pennsylvanian systems. This contact is marked either by the Harrison formation, a conglomeratic sandstone, or by an abrupt change from fine-grained to coarse-grained sandstones. The contact has no definite stratigraphic position, and hence the Harrison or the lithologic change occurs at various horizons on the old Mississippian surface.

The Pennsylvanian rocks consist, in ascending order, of a rather regular repeated sequence or cyclothem of marine beds, sandstone, shale, clay, and coal. In some of the higher cyclothems a fresh-water limestone may be present between the clay and the shale. The cyclothems are named for the included coal seam. This cyclothemic grouping allows the grouping of hitherto unclassified sandstones and shales in a genetically significant unit and also facilitates a systematic description of the stratigraphy. The top of the coal has been used as the dividing line between cyclothems instead of the base of the sandstone, as has been the previous practice in Ohio.

The Pottsville series in southern Hocking County is grouped into thirteen cyclothems and contains five definite marine units. These marine units are in ascending order: Poverty Run limestone, Boggs member, Lower Mercer limestone, Sand Block ore, and the Upper Mercer limestone. The most important stratigraphically is the Lower Mercer limestone, which has been used to correlate the bulk of the Pottsville sediments. Twelve coals have been identified in this series. With an average thickness of 200 feet, the Pottsville is present in all five of the townships in the area. The top of the series is the top of the Brookville coal.

Overlying the Pottsville in Starr and Washington Townships is the Allegheny series, which is grouped into twelve cyclothems. Five marine units are present in the Allegheny and are in ascending order: Putnam Hill limestone, Zaleski flint, Vanport limestone, Hamden limestone, and Washingtonville member. In the Lower Freeport cyclothem, a fresh-water limestone is present above the shale. Ideally, a coal should be present in each cyclothem; however, many of the cyclothems are incomplete and only eight coals have been identified. The most important stratigraphically of all the coals is the Middle Kittanning, which has been used to correlate the upper Allegheny strata. The series has an average thickness of about 200 feet. The top of the Upper Freeport coal marks the upper boundary of this series.

The Conemaugh series, with a thickness of 60 to 100 feet, is present only in the eastern part of Starr Township. Only three cyclothems have been identified in this series. The series is composed mainly of sandstones and shales. Only two coals are present; these are very poor and usually smut streaks.

STRUCTURE

The strata of southern Hocking County lie on the eastern flank of the Cincinnati arch and dip fairly uniformly to

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the east at the rate of 30 feet per mile or, in angular measurement, about one-quarter of a degree. Because of this dip the oldest rocks outcrop in the western part of the area, and the youngest in the eastern part.

Since no single unit crops out over the entire area, two structural contour maps have been drawn. One, on the Middle Kittanning coal, shows the regional structural trend; while the other, on the Berne conglomerate, is very irregular owing to highs and lows present on the underlying Cuyahoga formation.

ECONOMIC GEOLOGY

Southern Hocking County contains valuable deposits of coal, clay, oil, and gas. In the past, iron ore and sandstone were economically important. Of the twenty-five coals present, only four have been mined to any degree. They are, in decreasing order of importance: the Middle Kittanning (No. 6), the Clarion (No. 4a), the Lower Freeport (No. 6a), and the Brookville (No. 4). Over 90 per cent of all the coal mined comes from the Middle Kittanning seam.

Valuable clays are the Lower Kittanning and Clarion of the Allegheny series, and the Brookville, Middle Mercer, and Flint Ridge clays of the Pottsville series. The Diamond-Haydenville district in Starr Township is an important center for sewer pipe, tile, and brick products.

The geology of oil and gas does not come within the major scope of the report, but it can be stated that wells have been producing for years from the Clinton sand of Medina age and the Mississippian Berea sandstone. At the present time much of the area has been converted into an underground gas storage pool.

255 pages. $3.30. Mic 58-4289

Abstract published by special arrangement with The Ohio State University.

PALEOECOLOGY AND CORRELATION OF THE LOWEST EMERGENT CALIFORNIA MARINE TERRACE, FROM SAN CLEMENTE TO HALFMOON BAY

(Publication No. 25,377)

Cortez William Hoskins, Ph.D.
Stanford University, 1957

Because the Pleistocene terraces of coastal California are not continuous, their origin is not clear and their relative ages are uncertain. The geomorphic techniques that have been successfully employed in more stable areas for terrace correlation proved to be inadequate in this region. Accordingly, this study proposes and tests some new techniques for correlating marine terraces along linear coasts that seem to be of sufficient reliability to permit relating the emergent California terrace to the Pleistocene chronology of the north-central United States.

The dating and correlation method adopted arises from consideration of various theories of Pleistocene climatic cycles, which indicates that temperature change in the surface layers of the ocean is the best basis for the correlation of terrace fragments and that the mid-latitudes are where these temperature changes are probably most detectable.

To test the hypothesis that implied temperature changes is a useful technique, 32 fossil faunules were collected from the lowest emergent marine terrace between San Clemente, Orange County, and Halfmoon Bay, San Mateo County, a distance of 500 miles. The faunules were analysed statistically to ascertain as far as possible the paleoecology of the deposits. The results of the statistical analysis show that most of the faunules accumulated in shallow water less than 100 feet deep and about two to three degrees centigrade cooler than now, except in the Los Angeles area, where the water temperature fluctuated but was on the average significantly warmer.

Temperature information from the fossil faunules, taken from different segments of the low terrace, are plotted in a paleoisotherm pattern that is internally consistent and resembles the isotherm pattern along the coast today, except that the late Pleistocene paleoisotherms are displaced about 300 miles southward. The low terrace segments are concluded to be parts of a single terrace formed during a time of generally cooler conditions.

The low terrace is inferred to be of Sangamon (Riss/Würm) age, about 70,000 to 100,000 years B.P. (before present), mostly of late Sangamon age. Several lines of evidence support this inference: (1) the elevation of the old shoreline angle, because ocean levels probably have not stood considerably higher than at present since Sangamon time, (2) the paleoecology of the fossil molluscan faunules, (3) climatic evidence of associated fossil floras and vertebrate faunas, and (4) biochemical evidence such as paleotemperatures of the surface ocean water throughout Pleistocene time as determined by oxygen 18/16 ratios of pelagic foraminifera from deep sea cores, and radiocarbon 14 dates from the terrace deposits. All published radiocarbon dates and three reported in this paper show that this low terrace is older than 35,000 or 40,000 years B.P.

226 pages. $2.95. Mic 58-4290

STRATIGRAPHY AND DEPOSITIONAL TECTONICS OF THE NORTH YUKON-LOWER MACKENZIE AREA

(Publication No. 24,913)

Leonard John Martin, Ph.D.
Northwestern University, 1957

The North Yukon-Lower Mackenzie area lies in the northwestern corner of Canada, between the 65th parallel and the Arctic Coast, the 125th meridian and the Alaska Boundary.

Maps illustrating sections representative of the lithologies of the units treated are presented. The stratigraphic data is analysed in isopach and lithologic aspect maps, and in tectonic maps.

Strata of every Palaeozoic and Mesozoic system, as well as rocks of Precambrian and Tertiary age, are present. Dominant rock types are as follows: Precambrian and Lower Cambrian - clastics; Middle and Upper Cambrian - carbonates; Ordovician and Silurian - carbonates, black shales and bedded cherts; Middle Devonian - carbonates and shales; Upper Devonian - clastics; Mississippian

- carbonates; Upper Pennsylvanian and Lower Permian - clastics; Triassic - shales and limestones; Jurassic and Cretaceous - clastics; Tertiary - clastics.

Most of the eastern part of the area has formed part of the cratonic interior of the continent since Precambrian time.

Basins have occupied parts of the western half and southern margin of the area at many times. A belt running from the Keele Range to the northern Richardsons exhibited stability throughout most of the Palaeozoic.

Mountain building movements took place in the British-Barn Mountains area, probably during the Upper Devonian. Upper Devonian sediments believed to be in part derived from this disturbed area form a depositional body with the general characteristics of an ancient delta.

An uplift of the Ancestral Rockies type appeared in the northern Richardson Mountains area during the Pennsylvanian. The uplift was flanked by a complementary basin.

Laramide deformation strongly affected the western and southern parts of the area. Faulting of the Canadian Rockies type occurred in the Northern Ogilvie and northwestern Richardson Mountains. The southern Richardsons consist of an anticline of the Wyoming Rockies type.

104 pages. $2.00. Mic 58-4291

GLACIAL GEOLOGY OF A PART OF WESTERN PENNSYLVANIA

(Publication No. 25,284)

Robert Francis Sitler, Ph.D.
University of Illinois, 1957

The glacial deposits of Lawrence County and parts of Mercer, Beaver, Butler and Venango counties in western Pennsylvania are a part of the Grand River lobe of Ohio and Pennsylvania. The deposits are early Cary (Wisconsin) and Illinoian in age.

The purpose of the investigation was primarily to investigate the sedimentary nature of the materials, but some attention was also necessarily paid to their morphology.

Two Illinoian advances are indicated by different continuity and thickness of the drift, by multiple till sections, and by two series of pre-Wisconsin outwash terraces at two levels. The older Illinoian till is a sandy-clayey till, but is preserved in only a few places. It is usually expressed only by scattered erratics. The younger Illinoian till is silty-clayey and is relatively continuous. Illinoian valley trains occur in the Beaver and Little Beaver valleys.

Wisconsin deposits are represented by ground moraine, end moraine, kame terraces, valley trains, eskers and lacustrine deposits.

Petrographic studies of the Wisconsin till show that the tills of the same stratigraphic unit are texturally and compositionally homogenous. There is, however, a progressive increase in sand and a progressive decrease in silt in the till toward the end moraine. The amount of clay in the till remains relatively constant throughout the area. Heavy mineral analyses of the tills show that the principal heavy minerals are: magnetite, clino-amphibole, garnet, ortho- and clino-pyroxene, kyanite, apatite, tourmaline, sphene, rutile, zircon, epidote and collophane. Illinoian tills contain more zircon than the Wisconsin tills. The suite as well as the percentage of heavy minerals of all till samples is very similar.

The ground moraine is represented by a thin covering of a sandy-silty till which becomes coarser are more permeable toward the end moraine. The till is leached to a depth of about 5 feet.

The end moraine is represented by sandy-silty till which is coarser and thicker than the till in the ground moraine. This till is sometimes leached to a depth of about 12 feet. The end moraine exhibits a knob and kettle topography in contrast to the flat or slightly undulating surface of the ground moraine.

Kame terraces with a gradient to the south are represented in all of the major valleys by steeply dipping of poorly sorted sand and gravel.

Valley trains of flat-lying beds of fairly well sorted sand and gravel occur in all of the major river valleys.

Eskers are found in Mercer County in a belt about 15 miles long. The eskers are sinuous ridges of well sorted cobbles and coarse gravel and sand.

The lacustrine deposits which occur in the valleys of Slippery Rock and Connoquenessing creeks and their tributaries were not mapped in detail.

150 pages. $2.00. Mic 58-4292

STRATIGRAPHIC STUDY OF THE BRIVE BASIN, SOUTHWEST FRANCE

(Publication No. 25,395)

Richard Francis Walters, Ph.D.
Stanford University, 1957

The Brive Basin is a region of late Paleozoic continental deposits, extending over an area of approximately 200 square miles located on the southwestern flank of the Massif Central, 100 miles east of Bordeaux. The present study was undertaken in an attempt to determine the stratigraphic sequence and facies relationships within the basin, source areas of detrital material, conditions of sedimentation and possible sub-surface extension of deposits. The writer's conclusions are summarized below.

Strata of the Brive Basin are divided in this report into four units, from bottom to top: the Donzenac, St. Antoine, Lanteuil and Noailhac formations. The Donzenac formation consists of a basal white to grey cobble conglomerate which grades upward to predominantly coarse grained red sandstones; its thickness probably averages 150-200 meters. The St. Antoine limestone is composed of grey massive limestone lenses interbedded with nodular marls and shales; it is an excellent marker bed, having distinctive lithology and an average thickness of only 10 meters. The Lanteuil formation, whose thickness averages 150 meters, begins with a grey basal conglomeratic sequence which grades upward to fine-grained highly argillaceous red sandstones. The Noailhac formation consists of up to 200 meters of fine-grained non-argillaceous bright red sandstones, with winnowed conglomerates in the upper strata. The Noailhac formation can be readily distinguished from underlying units on the basis of color, sorting, and lithic and heavy mineral composition.

Detritus of pre-Noailhac formations was derived from sources northeast of the basin, including the adjacent

Bas-Limousin and other areas more distantly removed from the basin. Available information indicates strong chemical weathering and active leaching in source areas.

Pre-Noailhac sediments accumulated in a flood plain environment with through-flowing streams situated in an intermittently subsiding central region. Two distinct erosional cycles provided detritus for the Donzenac and Lanteuil formations; erosion was at a minimum during the deposition of the St. Antoine limestone.

Regional relationships of pre-Noailhac sediments indicate maximum thicknesses and deepest depositional facies in the central portion of the basin, between Varetz and Lanteuil. Marginal accumulations to the northwest and southeast contain restricted pebbles and heavy minerals of local derivation; lithology of these flank deposits indicates deposition in oxidizing environments. Deposits in the central area are more cosmopolitan in their composition, containing detritus characteristics of each flank in addition to "foreign" elements of distant derivation. Facies in the central area are generally coarser and in many cases suggest deposition in a reducing environment; lacustrine conditions prevailed locally during the deposition of the St. Antoine and lower Lanteuil formations, leading to the formation of massive lenticular limestones and black bituminous shales.

The Noailhac formation contrasts with underlying units in many respects. Detrital material probably originated from sources east or southeast of the Brive Basin. Deposition of the Noailhac formation took place in a continental environment which led to the accumulation of homogeneous deposits with no significant facies changes in the basin area.

Lateral variations in color, composition and thickness indicate the probability of subsurface extension of sediments to the southwest for a minimum distance of 100 kilometers. 218 pages. $2.85. Mic 58-4294

THE STRATIGRAPHY AND BEDROCK TOPOGRAPHY OF PORTAGE COUNTY, OHIO, AND THEIR RELATION TO GROUND-WATER RESOURCES

(Publication No. 25,310)

John Durfee Winslow, Ph.D.
University of Illinois, 1957

This report describes the stratigraphy and bedrock topography of Portage County, Ohio, and their relation to the ground-water resources of the county. The county is 504 square miles in area and lies in the Allegheny Plateau section of the Appalachian Plateau Province. Although still largely agrarian in its economy, the county lies in the center of the expanding industrial area of northeastern Ohio.

The climate of the county is humid, with an annual rainfall of 38.12 inches fairly evenly distributed throughout the year. The average annual temperature is 48.6°F. in the upland areas, and about 50°F. in the lower areas.

The consolidated rocks range from the Devonian Chagrin shale to the Homewood sandstone of the Pennsylvanian Pottsville formation. Surface exposures are few, especially in the western and southern parts of Portage County, due to the essentially continuous thick mantle of glacial drift. The Devonian and Mississippian sandstones and shales are below present drainage except in the northeastern and northwestern parts of the county; these rocks are placed in three groups: the pre-Berea rocks consisting of the Chagrin and Ohio (Cleveland member) formations of Devonian age and the Cussewago and Bedford formations of Mississippian age; the Berea sandstone; and the Cuyahoga group, consisting of the Orangeville, Sharpsville, and Meadville formations. The Pennsylvanian rocks, all members of the Pottsville formation, are arranged in three sedimentary sequences, the Sharon conglomerate and shale members of Morrowan age, the Connoquenessing sandstone and Mercer shale members of Lampasan age, and the Homewood sandstone member which constitutes the thick basal sandstone of Desmoinesian age. These Pottsville rocks are described from surface exposures and from the records of several thousand water and oil and gas wells. The erosional unconformities at the base of each of the sandstone members of the Pottsville formation each represent a significant time break. Many of the numerous persistent units present in the Sharon shale and Mercer shale members in the Pennsylvanian basin to the south of the county are either discontinuous or wanting in Portage County. In addition, the sandstone members are thicker and these facts indicate that the northern boundary of the Pennsylvanian basin was close to the county area.

The Paleozoic rocks have been deeply dissected by pre-glacial and Pleistocene streams and by ice scour. The largest of these now buried valleys is part of the valley system which drained parts of Portage and surrounding counties in Teays time that has been deepened by ice scour during Pleistocene time. The glacial drift in this buried valley has a maximum thickness of nearly 700 feet.

The principal sources of ground-water in the county are the sand and gravel deposits in the buried valleys and the coarse Pennsylvanian sandstones, the Sharon, Connoquenessing, and Homewood. The Mississippian Berea sandstone is the source of water for the village of Garrettsville, and also for a few domestic and stock wells in the northern part of the county, but the depth to the Berea, plus the variation in the quality and quantity of the water detract from its value as an aquifer.

At present most of the ground-water pumped in the county is for domestic and stock use. The capacity of these wells is usually rated at between 5 and 10 gallons per minute. The use of ground-water for irrigation and industrial purposes is increasing. Wells drilled for these purposes have pumped a maximum of 1,250 gallons per minute from coarse sand and gravel lenses in the buried valleys, and as much as 850 gallons per minute from the sandstone members of the Pottsville formation.

121 pages. $2.00. Mic 58-4295

TECTONICS AND TECTONIC HEREDITY IN THE SOUTHERN BEARTOOTH MOUNTAINS, WYOMING

(Publication No. 23,890)

Donald Underkofler Wise, Ph.D.
Princeton University, 1957

The concept of control of Laramide structure by the roots of ancient mountain systems has long been part of

the working hypotheses on the tectonics of the Middle Rocky Mountains. The present work is an attempt to test this hypothesis and its possible mechanics by the structures of a single area and to set this area in the tectonic framework of the region.

The area chosen is part of the Beartooth Uplift of Montana and Wyoming. The Uplift is a crudely rectangular block of crystalline basement raised two to four miles above the adjacent basin floors and having the northwest-trending Cooke City sag down its long axis. The Southern Beartooth Mountains represent the Wyoming portion of that half of the Uplift northeast of this medial sag.

The problem was attacked by the mapping or statistical sampling of all recognized structural elements, both Precambrian and Laramide. Four major elements of Precambrian structure were determined: (1) A series of great folds, plunging thirty degrees to the south-southwest, are composed of an intimate mixture of granites and metasediments. (2) A group of mafic dikes has a pronounced northwest trend. (3) On a regional basis, a group of ultramafic bodies occur along two northwest-trending lines suggesting a similar trending ancient alpine belt. Within a single map area the orientation of these bodies is a matter of local structures. (4) Two sets of nearly vertical fracture cleavages have a uniform north-south and east-west orientation over the area and probably over several of the other ranges.

Laramide deformation was predominantly by basement faulting with the later sediments draped passively over the active fault blocks. The major local control of Laramide faulting in the area is the north-south fracture cleavage. Reshearing of this cleavage permitted some gentle slip-folding of basement. In local fault control, the migmatitic fold complex is essentially isotropic but on a broader scale a wide belt of more common leucogranite near the range front may control the western edge of the Big Horn Basin. The mafic dikes have almost perfect parallelism with the faults of the medial sag but are not in themselves faulted. Like the regional trend of the ultramafic bodies, the dikes reflect a northwest-trending regional "grain" of the basement which probably controls much of the Laramide faulting.

The tectonics of the Southern Beartooth Mountains are those of predominantly vertical uplift of a block-like corner. The frontal faults along the Big Horn Basin can be seen to steepen with depth from lowangle thrusts to steep reverse and vertical faults. The block uplift postdates the northwest-trending faults with drape folds of the Big Horn Basin type. Some movement of the range perpendicular to its axis is indicated in the late stages of orogeny.

The general characteristics of the Middle Rockies are reviewed. Most important are: (1) the deepest basin depressions occur next to the highest uplifts and (2) range ends commonly show vertical movements without strike-slip tearing. A review of tectonic theories of simple vertical uplift indicates that these theories cannot account for (1), nor for low angle thrusts, and necessitate a complimentary theory to explain the force distribution. The simple horizontal compression theories of wedges and inclined ramps are reviewed and subjected to criticism on grounds of excessive tear faulting of range ends and excessive crustal shortening. A composite "fold and pump" hypothesis is proposed whereby gentle crustal folding pumps material from beneath the downwarps to assist in producing range uplifts from the anticlines by combined vertical and horizontal forces. 263 pages. $3.40. Mic 58-4296

HEALTH SCIENCES, PATHOLOGY

PATHOGENESIS OF CALCIFICATION IN MOUSE LIVER AFTER INJURY BY CARBON TETRACHLORIDE

(Publication No. 23,425)

Katherine Livingstone Bick, Ph.D.
Brown University, 1957

The livers of young adult male mice, maintained on a 54% casein diet and injected subcutaneously with carbon tetrachloride, undergo extensive centrilobular necrosis by twenty-four hours. Repair of the injury is delayed as compared to that in mice on basal diets, and an infiltration of endothelial-like cells into the necrotic area is prominent by three days. By five days these cells have surrounded the necrotic material and fused to form multinucleate giant cells. Fibrosis is also evident at this time. By ten to fourteen days the fibrotic material is resorbed, and the only remaining pathological feature is the giant cells which persist as long as four weeks after injury. In contrast, mice on basal diets show essentially complete repair of damage by five days after carbon tetrachloride injection.

Calcium appears in the livers at twelve to sixteen hours, possibly as calcium proteinate. At twenty-four hours some calcium is bound as calcium phosphate. Acid mucopolysaccharides are not involved in this calcification. By three days the whole necrotic area is filled with calcium phosphate and proteinate, and by five days this calcium is segregated within inclusions in the giant cells. Calcium, as calcium phosphate embedded in a matrix of glycoprotein, is always found in the giant cells as long as they are seen in the liver. In the livers of mice on basal diets where giant cell formation and calcification do not routinely occur, demonstrable calcium appears in the liver only transiently from twenty-four to forty-eight hours after carbon tetrachloride injection.

A great increase in alkaline phosphatase activity occurs in these livers which is almost entirely due to the invading endothelial-like cells. The accumulation of phosphatase and that of calcium are parallel processes, but there is no indication that phosphatase activity is directly involved in this calcification. It may also be associated with a great increase in the number of reticular fibers around the giant cells and throughout the necrotic area, or in the production of phosphate for combination with calcium.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Changes in the level of dietary calcium did not affect the course of calcification. In mice protected against carbon tetrachloride damage by sulfaguanide calcium does not appear in the liver. The complete absence of calcium in liver necrosis produced by both burning and ligation indicates that the injury induced by carbon tetrachloride differs from that produced by these agents.

A possible explanation for the role of calcium in the centrilobular necrosis induced by carbon tetrachloride administration is proposed. The primary damage is a lesion of the cell membrane whereby calcium and water are allowed to enter the cell indiscriminately. The abnormal accumulation of calcium disrupts both structural and functional integrity of the mitochondria, with the resultant cessation of energy production and cell death. This occurs initially in the mid-zonal area of the lobule. Secondarily, the ischaemia and anoxia induced by the swelling of the parenchymal cells aggravates the injury. The final centrilobular necrosis is probably the result of the interaction of these factors. 66 pages. $2.00. Mic 58-4297

HEALTH SCIENCES, PHARMACY

AN ANALYSIS OF PROFESSIONAL PHARMACEUTICAL PERSONNEL IN TEXAS PHARMACY

(Publication No. 25,164)

Esther Jane Wood Hall, Ph.D.
The University of Texas, 1957

Supervising Professor: Dr. A. H. Chute

This investigation was made to obtain data to furnish accurate and comprehensive facts on the supply, character of employment, location, benefits, and other characteristics of professionally trained pharmaceutical personnel in Texas. It was planned to provide information on which might be based an effective solution to the problems of pharmaceutical manpower, training, education, and recruitment to the ranks of pharmacy in Texas.

Consideration was given to the factors which affect manpower demand and to those that affect manpower supply. Also consideration was given to the proper distribution of physicians, pharmacists, and pharmacies in order to provide adequate medical care for the population of the State of Texas.

The characteristics of the existing and potential supply of pharmacists were analyzed with regard to numbers, character of employment, educational characteristics, and age of the pharmacists as well as pharmacy distribution. Sources for potential are through examination and registration, reciprocity, and re-entering the profession. Although the total number will increase, there is a relative decrease in the number entering practice within Texas. Retail pharmacy attracts the majority, with a trend also toward hospital pharmacy. College graduates predominate among those active in the profession. A relative decrease among those under 50 years of age connotes a corresponding increase of older pharmacists.

The typical Texas pharmacy is a one-man operation. The yearly potential supply of pharmacists available from all sources was less than three hundred. The deduction of 125 exits for various reasons would leave a net annual addition of 175 to the profession.

Findings in this dissertation seemed to indicate that women can be developed into an auxiliary force to relieve any shortage of pharmacists. This can be accomplished by recruitment and through encouragement to women pharmacists to continue in or to re-enter the profession. The Negro sector of the population is shown to be adequately provided with pharmaceutical educational facilities. However, many of the graduates presently are being diverted into activities other than retail pharmacy.

Population projection estimates were analyzed in order to approximate the extent of the educational program that will be needed for pharmacy to provide adequate medical care in the future. There apparently will be at least 1,100 students enrolled in Texas colleges of pharmacy in 1960. The institution of the five-year program of pharmacy education in 1960 may warrant a re-examination of recruitment aims and procedures. Both quantity and quality will be important; therefore, predictive tests should be included as a part of the entrance requirement. Internship should be made more meaningful to the student or its requirement for registration abolished.

Surveys among the registered pharmacists themselves indicated that the average compensation was $500 per month for a 50-hour week. Fringe benefits were vacations with pay, holidays, and employee discounts. Profit sharing or bonus plans and retirement benefits are needed. Employment in hospital pharmacy or as medical sales representatives is second in importance to activity in retail pharmacy.

On the whole, the potential supply of registered pharmacists for the State of Texas will be adequate on the basis of quality by virtue of the improved educational standards to be adopted. Quantitative needs for Texas pharmacists might be eased if professional pharmaceutical personnel could be better utilized in activities that fall under the head of professional pharmaceutical service and if marginal pharmacy outlets could be discontinued. An improvement in administration in retail pharmacy, including personnel, could be made if a mandatory provision is adopted for teaching the principles of business operation as a background for retail pharmacy operation.
217 pages. $2.85. Mic 58-4298

STUDIES ON THE DEGRADATION OF SULFADIAZINE SODIUM SOLUTIONS

(Publication No. 25,340)

Charles Judd Swartz, Ph.D.
University of Maryland, 1957

Supervisor: Dr. John Autian

Solutions of sulfadiazine sodium undergo color changes and precipitation on prolonged storage. The degradation products, even though they do not interfere with the therapeutic value of the sulfadiazine, make the product efficaciously objectionable from the viewpoint of the clinician

and the manufacturer. In the first phase of this study, the nature of the coloration and precipitation has been investigated utilizing infrared and ultraviolet spectroscopic data together with chemical procedures. Experimental evidence is presented attempting to identify qualitatively these degradation products.

It was furthermore felt that a quantitative study of the deterioration might shed further light on the process which has been concluded to be one of oxidation. Therefore a study employing five distinct measurements of activity was initiated on samples stored in diffused light at room temperature and those stored at 60°C. in an oven. This study extended over a 100 day period and the samples were stored in air filled, clear glass ampuls.

The addition of certain antioxidants to ampuls of sulfadiazine sodium solution prepared in a nitrogen atmosphere retards color changes in these solutions. The efficiency of various antioxidants to inhibit the development of color was investigated by determining the ability of these agents to utilize available oxygen in sulfadiazine sodium solutions at various hydrogen ion concentrations. Quantitative estimation of oxygen uptake was achieved by the utilization of a Warburg Constant Volume Respirometer. Ascorbic Acid, p-amino phenol, hydroquinone, nordihydroguaretic acid, sodium formaldehyde sulfoxylate, sodium sulfite and t-butyl hydroquinone were the antioxidants evaluated. The fat soluble antioxidants, nordihydroguaretic acid and butyl hydroxy anisole, were solubilized with Tween 80 and studied with the aid of the Warburg equipment also. Oxygen consumption data were correlated with actual formation of color in ampuls autoclaved for prolonged periods. The effect of various solvents on oxygen uptake in solutions of sulfadiazine sodium with and without antioxidants was observed. Those solvents evaluated included glycerin, propylene glycol, sorbo, polyethylene glycol 400 and carbitol. 88 pages. $2.00. Mic 58-4299

HISTORY

HISTORY, GENERAL

THE PHILOSOPHY OF HISTORY OF JOHN FISKE

(Publication No. 25,132)

Phyllis Ann O'Callaghan, Ph.D.
St. Louis University, 1957

John Fiske, known as an American philosopher and historian, combined both interests in a rather distinctive philosophy of history. In his effort to understand the universe as a whole, a Cosmos, he accepted the Positivist conviction that philosophy must ignore metaphysics and concentrate upon formulating laws expressive of the coexistence and succession of phenomena. The nature of those laws Fiske found in Herbert Spencer's multi-volume Synthetic Philosophy. Spencer had constructed a Law of Evolution which explained the history of all aggregates as they emerged from the imperceptible and until they disappeared back into the imperceptible. All phenomena, inorganic and organic, followed a course of integration and dissolution. Accepting this abstract law of universal development Fiske unconsciously had a comprehensive philosophic history.

Fiske, however, added several modifying phrases to this universal law and made it fit social phenomena only. Since social phenomena are studied through history and they reveal a distinctive Progress, the Law of Social Evolution became a Law of Progress and a Law of History. Both a theory and a history of Progress, then, can be culled from Fiske's philosophic and historic works.

The origin and destiny of Man occupied Fiske's thought too. The Law of Evolution in its unmodified Spencerian form was actually a Law of Evolution-Dissolution. Since each aggregate that evolved also reached a point where it must dissolve, the universe as a whole would probably also go through alternate eras of integration and dissolution. Fiske's philosophy of history did not concur in such a cyclical interpretation. With the aid of scientific discoveries, such as Darwin's, the Cosmic philosopher thought he could trace Man's "Creation" back to his pre-historic brute ancestry. With his Law of Social Evolution Fiske was able to interpret all history as a vast educative process, a progressive adaptation of man to his environment, physical and psychical. During this ages-long adaptation Man had become more and more selfless, peaceful, humanitarian, industrial, individualistic, liberal; while his philosophic and religious thinking had become increasingly conscious of the unity of the Universe and its immanent God. From this reading of the career of mankind throughout time Fiske arrived at a conviction devoid of scientific proof, but utterly reasonable to him. He concluded that Man had been elected by Nature for perfecting. When the intelligence of Man's "half-human" progenitors reached a certain point, Natural Selection had ceased working on organic changes and concentrated on the Progress of civilization. As Man's psychical development continued he was separated from his brute ancestry. Man was coming ever closer to the "good life" here on earth, but he would never completely achieve it. Fiske placed the consummation of human living and the meaning of human existence in immortality, an "Everlasting Life." This goal was reserved to Man since he alone in this world contained an element of Spirit, namely conscious life. The Matter of the Universe might be scattered, material reality dissolved, but this element of permanency remained with Man. It was an assurance that the course of human life had not been for nought, regardless of what happened to the rest of the Universe. Man's ultimate destiny was an immortal life which he would enjoy with God.

246 pages. $3.20. Mic 58-4300

HISTORY AND BIBLIOGRAPHY OF MIDDLE TENNESSEE NEWSPAPERS, 1799-1876

(Publication No. 25,291)

Guy Harry Stewart, Ph.D.
University of Illinois, 1957

One of the great needs of historians in recent years has been more accurate and up-to-date bibliographies of American newspapers. For a number of years, now, historians and other researchers who have turned to newspaper bibliographies have found them inadequate, if not nonexistent.

Since it would tie in the editor's location with his interests in history and journalism, it was determined that Middle Tennessee should be the area for study. An effort was made to uncover new titles and to discover as many previously unknown issues as possible. A thorough check of all presently known holdings was also made. These joint goals aimed to enhance another which was to provide a solid bibliographical work for this section of the country which could be used authoritatively by future historians as they worked on local, sectional, regional, and national history dealing with this area of Tennessee.

For the data to be included in each bibliographical description, a form was devised which indicated the city in which the paper was published, the title of the paper, frequency, and beginning and terminating years, unless the latter extended beyond the limiting year of the thesis, all in an identification line. Immediately following the identification line came a paragraph of data including: authentication for date of first issue (if available), publisher and/or editor, changes in titles with any accompanying changes in publisher and/or editor, changes in titles with any accompanying changes in publisher or editor, changes in frequency, location, and volume number, changes in frequency of publication of first title, and authentication for last issue, if available.

At the same time that the bibliographical data was being gathered, information was taken in note form for an historical essay on the development of the press in Middle Tennessee in this era. Special attention was paid to the problems of the press and how they were met, general content, life of the papers, editorial attitudes on important subjects of the time, emergence of dailies, political papers and military organs, why papers were located in certain areas, information about one paper often found in another paper under scrutiny, and other miscellaneous data.

The greatest concentration of Middle Tennessee newspapers for this period is to be found in the State Library and Archives, the State Historical Society, and the City Library, all in Nashville. Other important holdings are in the Lawson McGhee Library (Knoxville), the Library of Congress, and the American Antiquarian Society (Worcester, Mass.).

In brief, the goals as described above were reached as follows:

(1) 127 new newspapers were discovered;

(2) 21,134 previously unknown issues were found;

(3) 67,449 issues including the new ones were examined individually;

(4) 28,751 issues, located out-of-state, were verified by correspondence, more than 91 percent of which are duplicates of issues already examined in Tennessee or on film;

(5) an expanded bibliography of slightly more than 96,000 issues of Middle Tennessee papers (1799-1876) is now available for future historians;

(6) a brief historical essay covering the development of the press in Middle Tennessee precedes the bibliography.

288 pages. $3.70. Mic 58-4301

HISTORY, MEDIEVAL

THE EMPEROR HENRY VII AND THE ITALIAN CITY STATES

(Publication No. 23,802)

William Marvin Bowsky, Ph.D.
Princeton University, 1957

The arrival of Henry of Luxemburg, King of the Romans and emperor elect, in Italy in 1310 was an event of major importance. For more than half a century the cities and lords of the Kingdom of Italy had been conducting their affairs free from imperial supervision. In the process of expanding many communes had usurped rights and jurisdictions over lands and persons that by right depended directly upon the emperor. Native signori were ruling over Lombard cities without having any authority from the emperor to do so. The coming of an emperor elect made men consider their positions and take a stand for or against their rightful ruler.

Much depended upon the aims and methods of the emperor elect. Henry of Luxemburg had shown himself to be an able diplomat in northern Europe, where he was familiar with the problems and the ways of thought and action. He came into Italy unprepared in almost every sense, and ignorant of the situations with which he would have to deal. It was in large part because of this ignorance and lack of orientation that he was satisfied with making only very general and simple plans and applying the simplest solutions to the complex problems of his Italian subjects.

First, Henry wished to restore peace to an Italy torn by internal strife and civil wars, and to re-establish order, bringing justice to all. This done, he would hasten to Rome and the imperial coronation, and thence return to Germany. He intended to remain in Italy a very short time, and believed that his goals would be easily attained. Henry brought few troops and little ready cash with him, expecting to receive considerable military service and revenue from the Italians.

One factor that led the emperor elect astray in his treatment of Italy was his misconception of the nature and importance of guelfism and ghibellinism. To Henry these represented the political desires to see the predominance of the popes or of the emperors in Italy. Thus he thought that he could avoid serious opposition if he appeared in Italy supported by public papal approval. He wished to remain above party strife, dealing justly with all men, and winning the loyalty of both guelfs and ghibellines.

Henry was unaware that guelfism and ghibellinism signified neither the desire for papal nor for imperial rule in Italy, but were terms now void of ideological meaning, remaining in existence as convenient designations for

distinguishing various groups of local alliances struggling for domination in divers cities and regions. The terms "guelf" and "ghibelline" were not the master key for understanding and solving the political, social, and economic ills that were keeping the land in turmoil.

Nor did the Luxemburger seem to note that many men did not place peace and justice above the interests of their families or factions. No cities showed a real willingness to be ruled effectively by the emperor elect. All were ready to do him homage and render him some military service and financial contributions, but they did not wish to see their communal magistrates replaced by imperial officials or their surrounding districts placed once more in direct dependence upon the empire. And factions in power within cities did not relish the return of their exiled political enemies.

But Henry intended to rule effectively as well as to bring peace to the land. As the first places that he visited and reorganized had been controlled by guelf factions (as was most of Italy) he appeared to be substantiating the charges of his enemies, led by Florence, that he was set upon the destruction of Italian guelfism.

Faced with rebellions by Lombard guelfs, and having inadequate strength, Henry was forced to rely ever more upon those Italians who offered him their services; and they for the most part were ghibellines who expected substantial rewards. Henry demonstrated that he had no effective solutions for the difficulties disturbing Italian political life, or even for those created by his own policies, such as the restoration of political exiles to their native cities. His own blunders and inability made it possible for Florence to succeed in creating a new guelfism, and a Guelf League whose sole aim was the Luxemburger's ruin. Against his own will Henry was forced to abandon his above-party impartiality, and to act the part of a ghibelline chief.

His coronation a makeshift of substitutes, his siege of Florence a fiasco, threatened with excommunication by the very pope who had sponsored his journey, Henry died of malaria as he set forth upon a great war against the Italian rebels. Yet even as he was preparing for this supposedly ~~decisive campaign signs~~ of weakness and discord clearly appeared in the ranks of Henry's followers.

Italy was far different at Henry's death in 1313 than it had been at his arrival. Processes that had begun earlier had been hastened. The contestants in the struggle for power in imperial Italy were fewer in number, and stronger. In generalizing the use of imperial city-vicars Henry had greatly aided important signori by apparently legalizing their rule, and by giving them control over lands that had previously lain beyond their grasp. Now Tuscany, too, saw war-weary communes handing over their liberties to native signori, and the age of communal freedom was rapidly drawing to a close.

487 pages. $6.20. Mic 58-4302

ZUMARRAGA AND THE MEXICAN INQUISITION, 1536-1543

(Publication No. 24,940)

Richard Edward Greenleaf, Ph.D.
The University of New Mexico, 1957

Juan de Zumárraga, O.F.M., first Bishop and Archbishop of Mexico (1527-1548), served as Apostolic Inquisitor in his diocese from 1536 to 1543. The aim of his Inquisition was to preserve the Roman Catholic faith and dogma against all individuals who held heretical views or who were guilty of lack of respect for the Faith. Zumárraga like many sixteenth-century intellectuals was a segmented thinker. Although he professed to be a Christian humanist and follower of Erasmus, he was bound by Thomistic orthodoxy. In his trials of Indians for idolatry and sorcery, he encountered a situation where philosophical eclecticism and religious orthodoxy could not easily be reconciled. Erasmism had to give way to Thomism. Scholars have greatly exaggerated the influence of Erasmus, More, and other humanists in sixteenth-century Mexico.

As a lever between the Spanish and Indian cultures, the Indian Inquisition was a rather haphazard device in the process of forced acculturation. At this period, the Mendicant Orders, who were responsible for the instruction of the natives in the Faith, were handicapped by inadequate personnel. Many outstanding friars deplored the rudimentary nature of their teaching program. In view of this, Zumárraga's Indian Inquisition appears to have been a reprehensible phase of the spiritual conquest of Mexico.

Three other major phases of heresy occupied Zumárraga the Inquisitor: Lutheranism, Judaizing, and sorcery. Lutheranism never constituted a real threat to Mexican orthodoxy, although the term became almost a synonym for heresy. In spite of the numerous trials of Judaizantes between 1536 and 1540, the Jewish colony in Mexico continued to thrive and increase. Although Zumárraga made some progress in curbing the graver aspects of sorcery, he was not able to eridicate common Spanish and Indian superstitious practices and beliefs. In addition to major heresies, Zumárraga's Inquisition tried cases of blasphemy, moral offenses, and minor heresy; punished critics of the Holy Office of the Inquisition; and administered the property of those who came under censure.

Zumárraga ranks among the leading figures of early sixteenth-century Mexico. His activities as Apostolic Inquisitor and real founder of the Mexican Inquisition ran parallel to those of Viceroy Mendoza as founder of the Viceregal system in the Spanish Empire in America.

291 pages. $3.75. Mic 58-4303

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

HISTORY, MODERN

NATIONAL SOLIDARITY AND IMPERIAL POWER. THE SOURCES AND EARLY DEVELOPMENT OF SOCIAL IMPERIALIST THOUGHT IN GERMANY, 1871-1914

(Publication No. 25,139)

Abraham Ascher, Ph.D.
Columbia University, 1957

This study examines the political ideas of a group of men who espoused two themes dominant in late nineteenth century Germany -- imperialism and social reform for the working class. After an introductory chapter on the political and social setting in pre-World War I Germany, the three following chapters deal with writers who were essentially conservative in political outlook; the fifth is devoted to the Social Democratic imperialists; the conclusion summarizes the views of the men and movements analyzed in the study.

The "socialists of the chair," important and influential academic economists, were the first to propagate the two themes. Concerned for the well-being and stability of the German state, these economists favored a polity in which all classes would fully contribute to the strengthening of the national community and in which all classes would be guaranteed what they considered a fair share of the community's wealth. The workers, they feared, were so discontented with their lot that they would join, in increasing numbers, a political movement hostile to the prevailing order. Motivated by this fear and by certain moral considerations, the economists urged the state to put into effect far-reaching social legislation. By the 1880's they became convinced that territorial expansion was an economic necessity for Germany, and not the least for the German proletariat.

Adolf Stoecker, whose ideas are analyzed next, was troubled by the success of Social Democracy in diverting workers from Christianity and in exacerbating internal conflicts. His suggested remedies were extensive social reform, to be initiated by the state, and a campaign aimed at inculcating the citizenry with a passionate devotion to the Fatherland.

The first person to stress an interrelationship between imperialism and "socialism" was Friedrich Naumann. Dedicated to ideals such as the dignity of the individual and the elimination of poverty, Naumann advocated a moderate form of corporatism and state intervention on behalf of the underprivileged. But he regarded territorial expansion by Germany an economic prerequisite for the introduction of social legislation. At the same time he contended that the expansionism he envisioned could only be carried out by a unified Germany, free of class conflict. Social reform was to help bring about such unity.

Finally, within Social Democracy two groups of imperialists emerged, one on the right wing of the party and one on the left. The former asserted that with the gradual democratization of the country and with the improvement in the economic condition of the lower classes, socialists could no longer afford a purely negative attitude toward the German state and its policies. They had to recognize that the proletariat could derive substantial benefits under the prevailing order and that to a considerable degree these benefits depended upon the prosperity of the country, which, in turn, was related to the success of Germany in her imperialist ventures.

The main argument of the left wing apologists for imperialism was that it represented a necessary stage through which capitalism had to pass before socialism could triumph. Hence, it was not the obligation of socialists to isolate imperialism as a particularly virulent aspect of capitalism and to struggle against it. For despite the sacrifices it imposed, socialists had to accept the fact that it was an inevitable stage, one that marked the last gasp of the capitalist class to maintain its dominant position.

In stressing both imperialism and social reform the men discussed in this study developed a set of ideas that adumbrated the program of some of the most extreme of twentieth century mass movements, which also propounded those two themes in the hope of gaining support from every possible social stratum. 337 pages. $4.35. Mic 58-4304

THE DEVELOPMENT OF POLITIQUE THOUGHT DURING THE FRENCH RELIGIOUS WARS (1560-1595)

(Publication No. 25,191)

Edmond Morton Beame, Ph.D.
University of Illinois, 1957

The conception of the Politiques as a practical political party interposed between the Huguenots and the Catholics which, by divorcing reasons of state from religious considerations and devoting itself to the idea of the modern nation, saved France from the devastation of the Religious Wars has been accepted by most modern historians. While this view may be useful in part, its validity in studying Politique thought is limited. Actually the Politiques were not a political faction in the modern sense; attempts to define them as such have proved to be either replete with contradictions, incomplete, or inconclusive. They are best understood as an indistinct group of men united by their moderate natures and peaceful inclinations.

Politique thought grew out of the reactions of these men to the major issues of the Religious Wars. Foremost among the problems which held their attention was the question of toleration. In this their attitudes were conditioned by a tradition of Christian humanism and, to some degree, by Averroistic fideism. Their belief that inner faith was more important than outward ceremonies, that dogma was subordinate to living a Christian life, and that the basic aspects of religion inherent in man transcend individual sects, made them unable to persecute for religious reasons. Fideism pointed towards religious relativism, tended to direct religion inward, and denied a rational justification to religious persecution. The religious ideas of the Politiques quided them towards a policy of toleration, not as an end in itself, but as a first step towards eventual religious reunion.

Variation characterized the ideas of the Politiques concerning toleration. In the main they accepted the traditional Catholic theory that toleration of heresy was possible only on grounds of expediency, and they asked for it as a means of preventing the ruin of the state by a religious conflagration. A few tended to consider toleration

as an absolute good in itself, while others more conservative opposed outright toleration, but eschewed persecution. The Politiques' solution to the toleration question was the most distinctive element of their thought, and it provides the only certain criterion for identifying a Politique.

Although considerations of state also impelled the Politiques towards toleration, they cannot rightly be termed advocates of a modern idea of raison d'état. They showed at least an equal devotion to religion as to the state, and their conception of the state was that of the medieval Respublica Christiana with its dual nature of terrestrial government and religious society. A nonmoral state was foreign to their thoughts. The Politiques were men of the Reformation period, and their ideas were more medieval than modern.

In reaction to the particular issues of the Religious Wars the Politiques developed political theories that are significant for the history of thought. Against the attempt of the Papacy to interfere in the French Church and kingdom they drew upon a Gallican tradition, infused it with conciliar ideas and theories of the divine right of the king to administer the church, and evolved the most complete expression of French independence from papal control advanced at any time during the Ancien Régime. As royal supporters against the Holy League and the Papacy they enunciated a theory of divine-right monarchy which contained contradictory elements of absolute power and a limited sphere of action for the king. Finally, when the cause of royalty and legitimate succession seemed threatened by efforts to dethrone Henry IV they emphasized the inviolable nature of the fundamental laws of the kingdom, especially that of the Salic law.

403 pages. $5.15. Mic 58-4305

A HISTORY OF FORT UNION (NORTH DAKOTA), 1829-1867

(Publication No. 25,119)

Sister Dolorita Marie Dougherty, C.S.J., Ph.D.
St. Louis University, 1957

Fort Union was the central fur depot for the Western Department of the American Fur Company. This branch of J. J. Astor's concern had its offices in Saint Louis under the management of Pierre Chouteau, Jr., Bernard Pratte, and other Saint Louis fur merchants. The building and operation of Fort Union and its smaller contingent forts was under immediate management of a group of fur traders known as the Upper Missouri Outfit. This group in turn formed an independent branch of the Western Department.

Fort Union was begun in 1829 by Kenneth McKenzie. It was located on the Missouri river near its confluence with the Yellowstone, in the heart of the fur country. The Missouri river served as a link connecting the upper Missouri fur posts with the Saint Louis office. The trade of Fort Union was carried on principally with the Assiniboine Indians, the poorest of the Upper Missouri tribes, but expert buffalo hunters.

Since the American Fur Company aimed at a monopoly in the Missouri region, the story of Fort Union is largely one of trade wars, rugged individualism, cut-throat competition, and artful evasion of federal regulations regarding the sale of liquor to the Indians. Not until 1846, however, did the American Fur Company gain unchallenged ascendancy, and by that time the fur trade had passed its heyday and was on its downward trend.

Personalities play a major role in the history of Fort Union. Among the most colorful of the managers of the fort were Kenneth McKenzie, Alexander Culbertson and James Archdale Hamilton. McKenzie had a remarkable grasp of Indian psychology. He dressed and ruled in the manner of a feudal lord. Meals were served not only formally but almost elegantly, the food consisting of the ordinary fare served in the States, plus many luxuries. There was a strict ritual of ceremonies observed when treating with the Indians. The balls and cotillions given at the fort were attended by many, and the Indian women could be seen wearing the latest European fashions. Epidemics of smallpox periodically interrupted trade and claimed hundreds of victims.

On the whole the men in charge of the fort were of better than average education. They made the fort not only a refuge of comfort and security, but often spent many an evening in lively discussions on books, religion, and morals. Government scouts, traveling scientists, missionaries, and writers all found not only a delightful hospitality at Fort Union, but much enjoyable conversation and valuable assistance.

By mid-century the westward movement of white settlers roused the Indian tribes in the fur territory to relentless opposition, and made the founding of military forts a necessity. When gold was discovered in Montana and Idaho 1861-1862, loosing a fresh wave of immigrants into the region, the Indian tribes of Minnesota and the Dakota territory went on the warpath. The United States was at the time involved in civil strife and could spare few troops. In 1864 Captain W. B. Greer with a company of Wisconsin volunteers occupied Fort Union.

In that year Pierre Chouteau, Jr. sold the fort, along with several other posts, to a newly organized Northwest Fur Company. In 1867 the new owners dismantled the old fort and built a new one near the military post of Buford, which had been founded three miles below the site of historic Union. 237 pages. $3.10. Mic 58-4306

MARK CATESBY, NATURALIST, 1683-1749

(Publication No. 25,219)

George Frederick Frick, Ph.D.
University of Illinois, 1957

Pre-Linnaean naturalists have often suffered undeserved obscurity because of the revolution wrought in the natural sciences by the great Swedish taxonomist. One of those whose reputation was dimmed was Mark Catesby, the author of The Natural History of Carolina, Florida, and the Bahama Islands. As the English author of a book which was primarily American in its subject, Catesby was left in an ambiguous position where national historians of the sciences felt some hesitation in laying claim to him. The present study is designed to remove some of the obscurity which has surrounded his life and, even more, to evaluate his accomplishments in the terms of his own time.

Catesby's entire career was based upon the two trips which he made to America. The first, between 1712 and 1719, was spent largely in Virginia. His collections there brought him to the attention of the English botanical circle. Then, some of the leading members of that circle, with the approval of the Royal Society, sponsored his second journey to the New World in 1722. He remained in the Carolina low country and piedmont through the early part of 1725 and then travelled briefly in the Bahamas. His accomplishments during this period were extraordinary. He was, in many ways, a pioneer naturalist, who had few predecessors to build upon and had, in addition, to overcome both the natural obstacles of a new land and also those imposed by the unreasonable demands of his sponsors. He was, nevertheless, able to send home large quantities of specimens and to return with the water colors of the American flora and fauna upon which his Natural History was based.

Most of the remainder of his life was devoted to his great book, upon which he labored until 1747. This was a singular effort, as Catesby not only drew the original pictures, but engraved them and supervised their coloring personally. In the process he created what Richard Pulteney called "the most splendid of its kind that England ever produced."

Catesby's reputation loomed large among his scientific contemporaries. He was elected to the Royal Society and was closely associated with the leading naturalists of England. In addition, he corresponded with many leading figures in Europe and America. The result of this was to increase the number of specimens in the Natural History and also to further Catesby's second career in domesticating American plants in England.

The Natural History of Carolina was, though, the principal basis of Catesby's reputation in his own day and later. It was sufficiently important to go through three English editions and a number of pirated versions on the Continent. European compilers, notably Linnaeus, used it extensively in dealing with American species. It was, indeed, used as a basis for binary designations down into the early years of the nineteenth century. In addition, Catesby was an important artistic innovator, particularly in ornithological illustration. He developed the method of picturing birds in their natural settings which John James Audubon used so successfully a century later.

Mark Catesby was not a great naturalist; but he must be ranked among the first in the second order in his own time. His faults were mainly those of brevity and omission, while his strong points lay in his critical mind and his excellent, if untrained, artistic hand. In spite of his weaknesses, he produced the outstanding work on the natural history of British North America which was published before the American Revolution, a work upon which the great figures of the eighteenth century depended to build their systems. 247 pages. $3.20. Mic 58-4307

LINCOLN'S LEAGUE: THE UNION LEAGUE MOVEMENT DURING THE CIVIL WAR

(Publication No. 25,227)

Guy James Gibson, Ph.D.
University of Illinois, 1957

A number of patriotic and political organizations constituted the wartime Union League movement. They mobilized public support for nationality, emancipation, the Lincoln administration, and its war effort. They sought to influence administration policy in favor of such aims as emancipation in the border states, use of Negro troops, a constitutional amendment outlawing slavery, and civil rights for freedmen. Before the war an organization by the name of the Union League worked for national unity in the spirit of the Constitutional Union party, by opposing agitation of the slavery issue and criticizing Republicans for such activities. Union Leagues opposed to secession appeared in Maryland and other border states in 1861. The Union League of America, which was to become the largest group, was founded in June, 1862, in Pekin, Illinois. It soon spread to neighboring states and took the lead in forming a unified nation-wide organization. The claim that the leagues were initiated from Washington and had Lincoln's secret endorsement indicate, at the least, that the movement enjoyed important support from within the administration. The club leagues of civic and business leaders in Eastern cities and the allied publication societies were parts of the general movement but formally independent.

The state organizations show the tensions within the leagues between the various attitudes toward emancipation and the administration, their political activities, their opposition to the conservative Republicans, their demands for private home guard units, and their growing interest in civil rights in the areas to be reconstructed. The leagues were instrumental in securing emancipation in Missouri and Maryland.

The league demand that the Union party choose Radical candidates was aimed more at influencing administration policy than at securing a substitute for Lincoln. Although a few leaders favored a change, they found little support in the leagues. The relationship of Lincoln to the leagues is clarified by the consideration that he was the head of the Unionist coalition rather than the leader or supporter of the conservative faction. The existence of tension within the general Union movement does not justify placing Lincoln in opposition to the main body of the party and to the Union League. League opinion, including that of leading abolitionists, generally supported Lincoln. Some anti-slavery leaders even felt that he had taken too advanced a position in opposition to slavery and should return to the Union-only war aim. Gerrit Smith and John Jay had developed for the leagues the doctrine that winning the war and saving the Union should be the sole political aims at the time and that emancipation should not be made a condition of support of the Union party.

Some Eastern league leaders participated in the reconsideration of Lincoln's candidacy and of the constitutional amendment Union party plank during August, 1864, but this activity was primarily an effort to influence administration policies. In September the leagues united in enthusiastic support of Lincoln, in opposition to peace by compromise, and in favor of revision of the cabinet.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The national Union League meetings of 1864 and shown growing concern with the problems of reconstruction, and the organization was deeply immersed in questions of this nature when Northern victories and the death of Lincoln marked the close of the wartime phase of the movement.

The Union League was the antislavery movement in the time of the realization of abolitionist aims. It was the main organ of coalition in favor of nationality, emancipation, and Lincoln, and it was the great popular organization of the war.

The main sources of this study were minutes and other manuscript records of league groups, correspondence of leaders, and league circulars and pamphlets.

573 pages. $7.30. Mic 58-4308

NORDAU ON DEGENERATION: A STUDY OF THE BOOK AND ITS CULTURAL SIGNIFICANCE

(Publication No. 25,144)

Milton Gold, Ph.D.
Columbia University, 1957

Although there were anterior presentments of a deterioration in the quality of the arts, Max Nordau's Degeneration was the first book to attract Europe-wide attention with a theory purporting to prove that modern art was decadent, the product of degenerates in mind and body. Degeneration was written, read, and criticized during the 1890's, the fin de siècle, a period of uncertainty which seemed to mark the time between a creative past and an obscure future.

In writing Degeneration, Nordau was greatly indebted to a school of psychiatrists, mostly French, who attempted to define the mental and physical characteristics of so-called degenerates. Nordau particularly acknowledged the decisive influence of an Italian psychiatrist affiliated with the group, Cesare Lombroso, who, Nordau observed, had investigated the effects of "degeneracy" in all phases of human activity except the arts. In Degeneration he intended to complete Lombroso's work.

Max Nordau was born in Budapest in 1849, the son of a poor rabbi and Talmudic scholar. He began a career in journalism in his twenties, while at the same time completing his medical studies. Throughout his life Nordau maintained a medical practice, but continued to write books and articles on a variety of subjects. During the latter years of his life, he was active as a Zionist. Nordau travelled widely but resided most of his life in Paris, where he died in 1923.

Nordau's approach to social and philosophical problems suggests the influence of Comte; his political writings reveal a strong preference for a lower-middle class democracy. In his fiction and literary criticism, Nordau favored a "realistic" and a "classical" style. These are the ideas which form the background of his most important work.

In Degeneration, Nordau claimed to prove by "scientific" evidence and in strong, frequently abusive language, that almost all the important artists of the second half of the nineteenth century, namely Wagner, Ibsen, Zola, the Pre-Raphaelites, the Symbolists, Baudelaire, Wilde, and Nietzsche among others, were incurably degenerate. Nordau proposed a crusade against the so-called degenerate artists, in order to check the spread of the disease among the general public.

The critics, however, were not convinced by Nordau's thesis. In general they pointed out three fundamental faults in the book: (1) an ineffectual presentation, (2) a weak scientific argument, and (3) an impoverished philosophy of art. If Nordau hoped to arouse the educated public to a crusade against modern art, then Degeneration must be judged a failure.

Nevertheless, Nordau's critics seemed to be half convinced by the title before they read the book. Almost all of them were convinced that a "great secular hysteria" was beginning to pervade contemporary society. Moreover, with various qualifications they supposed that certain artists and social attitudes were degenerate and that others were not. In effect, there was reason to suppose that the critics of Degeneration might be more favorably disposed toward a more carefully reasoned explanation implying the same idea.

In the twentieth century, theories attacking art in modern times have been presented by Sigmund Freud, Oswald Spengler, Arnold Toynbee, and Arnold Hauser. Their theories, however, cannot be said to have "proved" the decadence of modern art, any more than Nordau's had before them. It seems probable that the evidence cited to prove a case against modern art is of so hypothetical a nature that, regardless of the apparatus through which it may be sifted the assumption of "the decadence of modern art" cannot be proven at all.

285 pages. $3.70. Mic 58-4309

DONOSO CORTES ON LIBERALISM

(Publication No. 25,121)

John Thomas Graham, Ph.D.
St. Louis University, 1957

Juan Donoso Cortés (1809-1853), Spanish statesman, orator, and writer, was a penetrating critic of modern European civilization and of its major ideological forces of liberalism and socialism. This once nearly forgotten thinker countered the optimism of the era of classical liberalism with a prophetic and pessimistic outlook which foresaw a ruinous end in communistic socialism.

Until 1849 Donoso was one of Spain's most noted liberals of moderate and doctrinaire position. A spiritual crisis in 1847 and the revolutions and reaction of 1848-1849 turned him to Catholic and authoritarian conservatism. His great speeches and writings after 1849 made him an intellectual and critic of European renown. His political and diplomatic thought and activity after 1849 have a place in the history of the time, but it is chiefly as a critic that he merits attention.

Donoso's critical thought was most incisive and complete when it dealt with liberalism. He treated classical liberalism, particularly that of France and Spain, as a middle-class ideology. He criticized it as a comprehensive system of theory (or doctrine), practices, and institutions, which combined ideas of the Enlightenment and French Revolution with the liberal thought and experience of the nineteenth century. His critique was abstract; it dealt with basic principles (or doctrines) and universalized

aspects of practices and institutions. He traced liberal ideas and practices back to rationalistic and naturalistic assumptions about God, man, and society. His method was to show internal contradictions, which, by logical and historical necessity, would make liberalism pass into or be overthrown by democracy and socialism.

This Spaniard criticized liberalism in most of its major tenets and institutions. In the historical order he treated liberalism as a necessarily passing phase of middle-class power and institutions between absolute monarchy and republican and socialistic democracy. In the intellectual and philosophical order he considered it as eclectic and incomplete--a political expression of a rationalism and naturalism which was passing on into nihilism and materialism. He wrote against the spirit and outlook of the time--materialism and optimism (progress and perfectibility). He asked for a religious and moral revival to prevent Europe from falling before revolution, socialism, and Russian conquest, with an eventual State communism of world dimensions. The political liberalism which he repudiated was, on the doctrinal side, chiefly French doctrinaire, and, on the practical side bourgeois parliamentarism and constitutionalism. He wanted to replace middle class power with an authoritarian government limited by a corporate society. In the social sphere he criticized liberal individualism as leading to socialist upheaval, and he called for a graded and corporate society based on the principle of group solidarity. On the economic side he condemned the materialism, corruption, greed and egoism of the liberal middle class. Like Marx, he predicted growing concentration of wealth and increasing misery, which would bring class war, revolution, and socialistic expropriation. Finally, he made some noteworthy criticisms of liberal pacifism and penal reform. 542 pages. $6.90. Mic 58-4310

THE CONSTITUTIONAL DEVELOPMENT OF NIGERIA: THE ORIGINS OF FEDERALISM 1862-1954

(Publication No. 23,904)

Godwin A. Odenigwe, Ph.D.
Clark University, 1957

Supervisor: H. Donaldson Jordan

The purpose of this dissertation is two-fold, first, to provide a systematic account of the constitutional evolution of Nigeria from the stage of an administered territorial division of an Empire to the status of a nearly independent state, and secondly, to point out the diverse conditions of the country and its peoples which made a federal system necessary. Materials used have been the various works on the political, economic, and social developments of the country, the successive constitutional and relevant legal documents, the reports on the administrative systems of the country, the activities of the leading nationalists and the themes of the nationalist press.

It was necessary to trace the internal and external historical influences which culminated in the administrative amalgamation of one Nigerian territory under the Governorship of Lord Lugard. From 1914 onwards, the course of development took the form of centralized policy through the Governor with diversities in legislative and local administrative patterns between the North and the South. While the Governor legislated alone for the North by proclamation, he did so for the South and Lagos Colony with the advice and consent of the Legislative and Executive Councils which sat in Lagos. Emphasis was placed on administrative efficiency and economic development, such as transportation systems, rather than on representative democracy. Little constitutional progress was made between 1922 and 1946, yet during that period certain prerequisite conditions developed which paved the way for the transformation of Nigerian territory to a nation state.

The events of the Second World War gave rise to militant demands for drastic constitutional reforms. The demands were sustained by the rapid development of national consciousness which was greatly influenced by the activities of the nationalists and their press and the administrative organization of the country.

To establish the thesis that a federal system was necessary for Nigeria, it was necessary to discuss the theories of federalism and its applications in the United States and many countries of the Commonwealth. The constitution of 1946, based on the principle of unity in diversity, was fully analyzed to demonstrate its essential federal features. Further constitutional advance ensured the evolution of the federal system which reached definite fruition in the establishment of the Federation of Nigeria in 1954.

Since 1946 constitutional development had shifted towards the growth of regional autonomy which was accelerated by the development of regionally concentrated political parties. This unique pattern of evolving Nigerian federalism was due to the devolution of functions from the Central Administration to the previously non-existent Regions. The consolidation of regional autonomy was a necessary condition for the success of the federal system.

Significantly, the Federation of Nigeria was established in 1954 without functioning responsible governments either in the Regions or in the Centre; nor was Nigeria as a whole politically independent. Premature acceptance of the federal system could lead to disintegration of Nigeria or probably aggravate existing problems. Such problems include the equitable division of financial resources and functions between the Regions and the Centre, common citizenship, national political parties, boundary adjustments, creation of more states and the position of the Trust Territory of the Cameroons. Also, constitutional advance could not automatically produce the trained administrators, skilled technicians and seasoned politicians for the tasks of economic development and political independence.

In spite of these problems, an independent federal Nigeria is indicated by many factors. Not only the British responsibility for presiding over this development but also economic bonds, national historical experiences and the desire and determination of Nigerian peoples point in the direction of a federal Nigerian state.

412 pages. $5.25. Mic 58-4311

A SOCIAL HISTORY OF NEW ORLEANS, 1850-1860

(Publication No. 25,174)

Robert Clemens Reinders, Ph.D.
The University of Texas, 1957

Supervising Professor: Dr. Barnes Fletcher Lathrop

This dissertation is primarily descriptive of ante bellum New Orleans rather than interpretative; however it attempts to shed new light upon some traditional views of the city with special reference to the class structure, and to present a picture of the forces of cohesion and division at work in the city.

The author has discussed several unifying elements which brought together the diverse citizenry of New Orleans. Among these elements are the public schools, the press, opera, the popular fire companies and militia units, charitable and benevolent organizations, and certain recreations. Separating the citizens were such forces as the class system, racial differences, and political and religious opinions.

Traditional views of ante bellum New Orleans have polarized the city into two classes, the Americans and the Creoles. A closer study of the class structure of New Orleans in the 1850's reveals the fact that Creole-American divisions were no longer important, and that the wealthy Creoles and wealthy Americans formed the nucleus of the city's upper class. This upper class was bound by ties of marriage and commonly-held economic and political beliefs. A middle class, generally American in origin, with some Creoles and immigrants, has seldom been considered in works on ante bellum New Orleans. But by the 'fifties it had formulated its own traditions and attitudes. A working class was composed almost entirely of immigrants. The Negroes belonged to a separate caste. Among the free Negroes a class system was constructed which approximated that of the whites.

The greatest part of the dissertation is concerned with the social life of the New Orleans citizen. The way and the manner in which he might have spent his time is treated in detail. His health, his organizations, his religion, his artistic and intellectual life, and especially his entertainments are illustrated.

In order to provide a balanced picture of New Orleans in the 'fifties the early history of the city, the physical setting, the economy, and the political struggles are also depicted. 881 pages. $11.15. Mic 58-4312

AGRICULTURAL ORGANIZATIONS IN ILLINOIS, 1880-1896

(Publication No. 25,278)

Roy Vernon Scott, Ph.D.
University of Illinois, 1957

The rise of the Alliance movement and its political counterpart, the Populist party, constitutes a significant watershed in American history. Faced with a loss of status and a steadily deteriorating economic condition, farmers turned to organization as a means of regaining their position in the nation. The Alliance movement, the second agrarian uprising following the Civil War, engulfed the Middle West and the South during the sixteen years after 1880 but, in Illinois, unique conditions weakened it and altered its manifestations. Urbanization, excellent soils, and diversified agriculture in northern Illinois prevented the despair which produced violent reactions. Farther south, in the central section, heavy reliance on cereal production combined with ruinous prices for corn and wheat caused farmers to join nonpartisan organizations for social, educational, and cooperative advantages. In southern Illinois, poor soil, smaller farms, overwhelming reliance on cereals, and general backwardness gave the state its only region in which agrarian radicalism, in the form of independent political activity, could flourish.

The Alliance movement originated in Illinois. Not only did Milton George, a hitherto unknown publisher, establish the National Farmers' Alliance and support it for the first seven years after 1880 but he formulated the mode of operation and philosophy which contemporary organizations adopted. Besides George's association, four other groups existed in Illinois. The Patrons of Husbandry, a remnant of the great uprising of the 1870's, continued and, after 1886, began a slow revival. Because of its traditions, growing out of twenty years' experience, and astute leadership, it exercised a greater influence than its 11,000 members warranted. A third organization was the National Farmers' Alliance and Industrial Union. Reaching a peak strength of 12,000 farmers, the association introduced unpopular measures, attempted to absorb its competitors, and moved rapidly toward third-party action. The Patrons of Industry, a relatively unimportant group, originated in Michigan and spread into the northern Illinois counties where it claimed a few members. The most important order in the state, in terms of size and prestige, was the Farmers' Mutual Benefit Association. It arose in 1883 and, eight years later, contained over 50,000 members. In all, the Alliance movement in Illinois, by December, 1890, included at least 62,000 farmers and almost 50 per cent more local groups than the Grange claimed at the height of its power fifteen years earlier.

Such a large body of organized farmers presented opportunities for political ventures. By 1890, the pressure from independent farmers and perpetual candidates was so great that, although every organization in the state proclaimed its nonpartisanship, agrarian leaders were unable to control local groups which proceeded to nominate independent candidates on the congressional, state senatorial district, and county levels. When the rural elements scored isolated victories and contributed to Republican defeats, every organization in Illinois claimed credit and adopted the successful independents as their own representatives. In the senatorial election of 1891, however, the farmer independents showed that they were not immune to corruption. When John M. Palmer the Democratic candidate, was elected with the aid of agrarian votes, under suspicious circumstances, the result for agricultural organizations was disastrous and independency was given such a blow that it never recovered. Disintegration began on all sides and when the Populist party appeared, there was little support for it.

In the broad sense, however, the Alliance movement in Illinois was by no means a failure. It taught the farmer the value of nonpartisan union, gave him a social medium, exposed him to new ideas and techniques, and reduced the monotony of rural life. Finally, it presented and

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popularized demands for reforms which, only a few years later, were universally accepted.

318 pages. $4.10. Mic 58-4313

THE POLITICAL THOUGHT OF PETER B. STRUVE, 1870-1917

(Publication No. 25,315)

Bernard Louis Zagorin, Ph.D.
University of Illinois, 1957

Peter B. Struve was born at Perm, a city of north-east European Russia, in 1870. He grew up in an atmosphere of intense political activity, and as sensitive as he became to social and political events, Struve could not help but notice (and eventually be drawn into) the heated doctrinal dispute that was going on in the literary arena. The Russian intelligentsia was split by a great debate in which the future of capitalism in Russia was the issue and the Marxists and the Populists were the contending parties.

It was during this period that Struve, fresh from studies concerning capitalism and socialist theory and having been strongly impressed by the then growing socialist parties in Western Europe (mainly in Germany), turned socialist convinced of the inevitability and imminence of a revolution. He reached the conclusion that socialism was an "historically inevitable result of the objective process of economic development." Struve had become convinced that the growth of capitalism was a necessary prerequisite for laying the basis of socialism.

However, he recognized, that unlike Western Europe, Russia presented a special case in view of its economic, social and political backwardness. The central problem of the whole controversy, Struve believed, was

(1) What economic processes, what social relations and forces would determine the downfall of the autocracy and help toward the conquest of civil and political liberties?

This, Struve believed, was the nub of the controversy that was taking place between the Marxists and Populists. There was not any hesitation on his part to enter into the controversy, so convinced was he of the correctness of the Marxist position. In 1894, Struve achieved his first success as a writer friendly to Marxism with the publication of his Critical Notes on the Economic Development of Russia. This work represented the highpoint of a movement which has come to be known as "legal Marxism." In other words it was literally the first major work devoted to a critical analysis of the Populist conceptions, and to the defense of the Marxist theory of social theory of social development as applied to Russia.

As the end of century approached, a brilliant and articulate leader of the German Social Democratic Party, Edward Bernstein, had been boldly attacking the intransigeant revolutionary spirit of Socialist doctrine. The labor theory of value, the iron law of wages, the class struggle--one by one, these sacred tenents of Social Democratic theory had been submitted to incisive and ruthless criticism.

Struve, utilizing the theories put forth by Bernstein, first directed his fire at individual dogmas of Social Democracy--the labor theory of value, the iron laws of wages. It was only a short while before his criticism was extended to the entire body of Marxist theory. In 1900 Struve formulated a theory of social change diametrically opposed to the Marxist concept of revolution: he advanced the proposition that the transition from capitalism to socialism would take the form of a gradual socialization of capitalist society.

From 1900 on, Struve was to direct his effort toward the development of a liberal movement founded on the recognition of the absolute and universal value of the individual consciousness.

In the spring of 1901, Struve published a secret memorandum that S. Witte had drawn up for the attention of the tsar. Struve used this document to call for the formation of a moderate liberal party. In March 1902 a series of private zemstvo conferences agreed on the publication abroad of a moderate liberal organ, and three months later, thanks largely to Struve's efforts, the first issue of this organ, Osvobozhdenie (Emancipation), was published in Stuttgart.

Struve edited the paper until the year 1905. From that time onward he turned increasingly to the right where he defended not only the existence of the tsarist government but also its right to pursue a policy of imperialism.

After the Bolshevik seizure of power in November, 1917, Struve declared himself from the very first in favor of the armed struggle against Soviet rule and maintained close contacts with the military and civilian leaders who were organizing White armies in the South and various border districts of the country.

A year and a half later, Struve followed the summons of General Wrangel, Commander-in-Chief of the Russian White Army in the Crimea, to become his Foreign Minister.

145 pages. $2.00. Mic 58-4314

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BASIC UNDERSTANDINGS OF FAMILY LIVING DEVELOPED THROUGH THE COLLEGE HOME ECONOMICS CURRICULUM

(Publication No. 24,088)

Ilene Brown, Ph.D.
The Ohio State University, 1952

Today, as in previous years, the family is the basic unit of American society. Happy families contribute to the happiness and welfare of individual family members and, more broadly, to a feeling of satisfaction and well-being among all families throughout the community, state, and nation. It is exceedingly important that people understand the influence of wholesome, satisfying family living upon the social adjustment of individuals, particularly children and youth.

Knowledge of the development of human personality and the understanding of human behavior come from many sources: anthropology, sociology, psychology, physiology, education, and home economics, to name but a few. The importance of an interdisciplinary approach to problems of home and family living is being increasingly realized, as the reports of the recent Midcentury White House Conference on Children and Youth, the "Report of Post Conference for Home Economists Who Attended the Midcentury White House Conference on Children and Youth", and the work of the National Conference on Family Life, held in Washington, in May, 1948, indicates. Through such cooperative efforts, both within the field of home economics and between groups outside of home economics, colleges and universities may well expect to make greater progress toward effective programs of family-centered education.

In many ways home economics has assumed a vital role, and is making effective contributions to education for family living. However, there is still need for continuing cooperative effort on the part of all home economists in working toward the improvement of family life education for all college students.

The Nature of the Problem

It is assumed that some understanding of families and how they live is basic to family life education. Therefore, the major concerns of this study have been to determine some of the knowledge about family living that is important for the college home economics curriculum, and to determine the extent to which it is taught. More specifically, the objectives of the study were: (1) to formulate generalizations for use in determining the kinds of knowledge about homes and families important for a program of general education; (2) to determine the extent to which Texas home economics faculties accept knowledge about homes and families of various socioeconomic levels as basic to a family centered program in home economics; (3) to determine what kinds of experiences Texas home economics faculties provide for helping college students develop a broad understanding of family living in many kinds of homes; (4) to discover the extent to which college seniors in Texas know and understand various kinds of homes and families with different socioeconomic backgrounds, and whether home economics majors differ from other majors in this respect; and (5) to formulate the implications of the results of the study for further improvement of the college home economics program.

Two hypotheses were tested in the study: (1) that there is a systematic relationship between the importance home economics faculties place upon the knowledge of homes and families and student development of such knowledge; (2) that college students having a major in home economics tend to develop a better understanding of families and of how they live at different socioeconomic levels than do other majors.

Plan and Procedure for the Study

The procedure used in this study had three distinct phases: (1) formulation of generalizations from the literature, (2) collection of data from selected institutions, and (3) analysis and interpretation of the findings.

Formulation of generalizations.— What are some of the characteristics typical of the family in America today? What are some of the characteristics peculiar to families at certain socioeconomic levels? What knowledge about families and how they live is important for a college program designed to promote family life education?

In an attempt to answer such questions as the foregoing, pertinent literature was surveyed for some of the important facts concerning families. Especially helpful sources included publications from the Midcentury White House Conference on Children and Youth; Rural Family Living Charts of the Bureau of Human Nutrition and Home Economics, United States Department of Agriculture; and publications by the Committee on Human Development, University of Chicago.

A list of 164 generalizations was formulated from selected established facts about families and how they live. Two interviews were held with a sociologist of the Ohio State University faculty to substantiate these characteristics of families and the completeness of the literature to which the writer had turned.

The first testing of the generalizations was done in the Fall of 1951. Participants were five home economics faculty members from four different institutions and 13 home economics seniors from an Alabama institution. At about the same date an interview was held on a Texas campus with a former member of the Committee on Human Development, University of Chicago, regarding the statements about families and family patterns of living. Revision of several generalizations was made in light of the reactions made by these various individuals.

A jury of six home economists nationally recognized for their concern that home economics contribute to family life education was asked to read critically the revised list

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of 131 generalizations. Nineteen statements were eliminated, 13 new statements were added, and the wording of 8 generalizations was noticeably changed as a result of comments and suggestions offered by jury members. Final changes in the generalizations were made on the basis of suggestions from Committee members. The completed list of generalizations included a total of 125 statements, grouped in Parts I and II, with four categories represented in each part: (1) Family Characteristics, (2) Income and Employment, (3) Housing, and (4) Family in the Community. Statements in Part I pertained to the knowledge of families in general, and statements in Part II concerned the knowledge of families at different socioeconomic levels.

Collection of data from selected institutions.— Letters were written in March to home economics administrators in the 13 Texas state-supported institutions which had participated in the Texas Legislative Council study of home economics in 1950. These administrators were asked if they, members of their home economics faculty, and senior home economics majors and a comparable number of seniors in other fields were willing to take part in this study.

Mimeographed copies of the faculty check list were mailed a month later to the administrator of the home economics unit in each institution. Shortly afterwards, the student check lists with instructions concerning their return were also sent to the administrator. Nearly all check lists completed were returned by the end of the Spring Semester.

Interviews were held during May in each of five institutions with 4 to 8 faculty members and 8 to 16 home economics seniors selected because of evidences of leadership in home economics in the state and because they were representative of the various types of state-supported institutions of higher education. The purpose of the interviews was to secure first-hand reactions of faculty and students both to the generalizations about families and to their college program.

Four main questions served as a basis for the conferences with individual faculty members: (1) What was your reaction to the check list? (2) To which of the generalizations or groups of generalizations do you believe home economics courses contribute most? (3) To what extent have seniors who have gone through the four-year home economics curriculum in your institution developed such knowledge? (4) In what ways do you feel that in your particular courses you are helping students to develop essential knowledge of home and families?

The group conferences with home economics seniors were centered around three questions: (1) Do you believe that it is important for home economics students to develop the kind of knowledge included in the check list? (2) What experiences have been most helpful to you in learning to know many different homes and families? (3) What other kinds of experiences do you wish you might have had to help you gain a better knowledge and understanding of families and how they live?

Compilation of the data.— Participants in the study included 91 home economics faculty members; 290 senior home economics majors, including 3 boys; and 189 seniors from other fields including 50 boys. Faculty participants included 83 per cent of the home economics faculty members in the state colleges and universities of Texas, and the 290 home economics students represented 68 per cent of all home economics seniors enrolled in the 13 institutions. The student participants included majors in all areas of home economics in the 13 institutions and a cross-section of the other majors in those institutions.

Compilation of the data from faculty check lists consisted of tallying responses according to whether the individual believed the statement to be essential or not essential to understanding families, or whether she was uncertain of the importance of the statement. Comments of individual faculty members were also recorded.

Treatment of student reactions involved two procedures: (1) counting the "correct" and "incorrect" responses for Parts I and II, and (2) tallying individual responses to each generalization and each source of help listed. Equal numbers of check lists for home economics majors and for other majors were used in the analysis of individual statements or items. These samplings were chosen on the basis of consecutive numbering of completed check lists within a given institution.

Basic tables were set up showing the distribution of reactions of all three groups--faculty, home economics majors, and other majors. Institutions were identified in the tables by letters of the alphabet rather than by name.

Analysis of the responses to each item was made according to those on which there was: (1) a completely favorable response by all of the faculty and student participants in each institution, and (2) favorable response by 75 per cent or more of each of the three groups in each institution. Unfavorable response was considered as (1) unfavorable response by 50 per cent or more of each of the three groups in each institution, and (2) a completely unfavorable response to the statement by all participants in each of the three groups in each institution. Analysis was then made of the extent of agreement among institutions.

Responses concerning the various kinds of experiences which had helped students in developing basic knowledge of families were compiled according to sources believed helpful or those believed to have been most helpful.

Analysis of findings.— On the whole, it was found that the total faculty group believed a majority of the 125 generalizations regarding families to be important for students to know. The extent of favorable response by the faculty on the statements about general characteristics of families (Part I), and on statements concerning socio-economic levels of families (Part II) was somewhat greater than the extent of favorable response among either of the student groups. There was considerable difference of opinion among the faculty, but between home economics and other seniors and among groups in the various institutions, student information and understanding did not vary widely.

The total participating faculty group seemed to react slightly more favorably to generalizations about socio-economic levels of living than to those about general characteristics of families. Analysis of all student responses also revealed their understanding to be slightly higher in relation to socioeconomic levels. However, results of the item analysis, in which samplings of equal numbers of majors and non-majors were used, indicate that faculty and students were slightly more in accord with the statements concerning general characteristics of families than with those pertaining to socioeconomic levels. Both in relation to general characteristics and to levels of living, it appears that the faculty placed more importance on family characteristics and students had more understanding of them than any other category.

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A comparison of faculty and student reactions to the statements about socioeconomic levels of families shows that the number of statements believed essential at each level by the faculty greatly outnumbers the number of statements correctly identified according to levels by students. Furthermore, the faculty believed fewer of the statements at the upper socioeconomic level to be essential than those at the middle or lower levels. The largest number of statements believed essential by these respondents concerned families at the lower socioeconomic level. Students, too, appeared to know most about families at the lower level and least about families at the upper level. Home economics majors seemed to have a better understanding of families at the lower and the middle levels than did the other majors. On the contrary, the other majors appeared to have slightly more information about families at the upper level than did home economics majors.

Home economics faculty and students had very similar points of view concerning the courses both in home economics and in other departments which were believed to be helpful to students in learning to know homes and families. The two groups of participants indicated strong belief in the value of home economics and other courses alike. Only one-third of the non-majors believed home economics courses to be helpful, but two-thirds of that group relied upon courses in other departments for help in understanding families.

The home economics courses most frequently named by the faculty and majors as being helpful were in the areas of (1) family relations and child development, (2) home management and family economics, and (3) foods and nutrition. Of the courses in other departments, the social sciences were believed by a large majority of all participants to be especially helpful. The non-majors, more than the majors, thought professional education courses were also helpful. Courses in both the humanities and the natural sciences received little recognition as being helpful in understanding families and their patterns of living.

There was more similarity between majors and non-majors than between the faculty and either of the student groups concerning the types of out-of-class experiences which had been most helpful to students in getting to know homes and families. The four types of experiences believed by faculty to be most helpful, as indicated by the number of times mentioned, were (1) reading books; (2) experiences at home; (3) movies, newspapers, and magazines; and (4) visiting in homes of college friends. Students, on the other hand, checked "contacts with certain persons" as being most helpful. Students also believed "social activities" and "outside employment" to be of more importance than did the faculty.

All in all, evidence tends to support the conclusions that (1) in the case of home economics faculty and students, there is some indication that students tend to develop that knowledge which faculties believe important; and (2) there is no significant difference between the knowledge of families which home economics majors have and that which non-majors have.

Interviews with individual faculty members and a few representative home economics seniors in each of the five selected institutions further substantiate these findings. A review of comments made by faculty members during the interviews reveals that the faculty members do recognize the value of and the need for a family-centered approach in the home economics program, and that there is some effort made by them to do something about it. Home economics students, in group conferences, expressed their appreciation for the type of college training they had received, yet suggested additional kinds of experiences which they believed should be provided in the home economics curricula to enable students to know families better.

Implications and Proposals

The first hypothesis tested was substantiated by the findings. Evidence points to a systematic relationship between the importance home economics faculties place upon the knowledge of homes and families and student development of such knowledge. Findings indicate, on the other hand, that in the institutions studied, home economics students do not tend to develop a better understanding of families and of how they live at different socioeconomic levels than do majors in other fields. Two inferences are drawn from these findings: (1) Even though home economics faculties strongly believe that knowledge of family life is particularly essential for majors, the home economics curriculum is not increasing such knowledge any more than are other curricula. (2) There undoubtedly is a need for institutions to provide opportunities for all students to develop a broader understanding of many families with different patterns of living; but this need particularly exists for home economics departments in relation to their majors.

The extent to which home economics contributes to better family living for all students and to which home economics students receive a rich education in this respect will depend largely upon the philosophy and vision of individual faculty members, the administration, and the total faculty in the institution. It is the writer's belief that as teachers become aware of and give emphasis to family characteristics and patterns of living not only will students acquire basic knowledge about families but college faculties will develop a better understanding of the student and his home and community background.

The first proposal in light of the findings of this study is that the various faculties, having indicated belief in the students' understanding families, should frankly face the fact that home economics students do not excel and should ask why; faculty members should reexamine their own beliefs and practice in stressing this type of learning, and should find means of implementing and directing learning toward such knowledge. The second proposal is that the college home economics department should initiate a study to find where in the institution all students, and their own in particular, have an opportunity to learn about families. The third and last proposal is that as home economics units discover means of promoting interdisciplinary approaches to family life education within their own institution, they should consider the nature of cooperative research with other institutions which would strengthen such efforts. 334 pages. $4.30. Mic 58-4315

Abstract published by special arrangement with The Ohio State University.

SOME PHYSICAL AND CULINARY PROPERTIES OF RECONSTITUTED FLOURS MADE FROM COMPONENTS PREPARED BY TWO METHODS FROM TWO VARIETIES OF SOFT WHEAT

(Publication No. 24,772)

Sylvia Yuson de la Paz, Ph.D.
Cornell University, 1957

Flours from two varieties of soft wheat were separated into starch, amylodextrin, gluten and water solubles using two methods of fractionation by hand. The four components were combined in seven different proportions. A group of flours referred to as "middle ratio" flours had proportions similar to the average yield of fractions from the two flours by the two methods of separation. Compared to the "middle ratio" flours, the other flours had either a high: low or a low:high ratio of starch:amylodextrin, amylodextrin:gluten or gluten:water solubles. Cookies were prepared from the unfractionated and from the reconstituted flours. Subjective and objective measurements were made to study the effects of source of components, method of separation of components and proportion of components on certain properties of flours and cookies.

Compared to the unfractionated flour with the higher protein content, the unfractionated flour with the lower protein content had a lower acid sedimentation volume, a lower alkaline viscosity and a lower viscosity of the flour-water paste. The cookies made from both flours, however, had similar average length, degree of brownness, breaking strength and panel scores for odor, flavor and mouth feel.

Fractionation and reconstitution decreased acid sedimentation volume of flours, increased alkaline water retention capacity, decreased alkaline viscosity, decreased the viscosity of flour-water pastes and either inhibited gel formation or had no consistent effect on sag of gels. Effects on cookies were decreased average length, increased degree of brownness, increased breaking strength, decreased odor and flavor scores and loss of shortness.

Method of fractionation influenced the yield and composition of the different flour components and the results of most of the tests done on the flours prepared from the fractions and cookies made from the flours.

Within the proportions studied, the following observations were made. Decreasing the starch and increasing the amylodextrin decreased acid sedimentation volume of the flours, had no effect on acid water retention capacity, had no consistent effect on alkaline water retention capacity or alkaline viscosity, had no effect on the viscosity of flour-water pastes and had no consistent effect on gel formation or sag of gels. No effects were seen in the cookies. Increasing the amylodextrin and decreasing the gluten had no effect on acid sedimentation volume of flours, increased acid water retention capacity had no consistent effect on alkaline water retention capacity or alkaline viscosity, decreased the viscosity of flour-water pastes and had no consistent effect on gel formation or sag of gels. The effects on cookies were increase in average length, decrease in breaking strength and loss of shortness. Decreasing the gluten and increasing the water solubles increased acid sedimentation volume of the flours, had no effect on acid water retention capacity or alkaline viscosity, increased the viscosity of flour-water pastes and had no consistent effect on gel formation or sag of gels. The effects on cookies were decreased brownness, decreased breaking strength and increased shortness.

The data from this study indicate that method of separation of components may influence more properties of the flours made from the fractions than source or proportion of components. Source of components affected certain properties of the flours but not those of the cookies. Within the proportions used, varying the ratio of amylodextrin: gluten and gluten:water solubles seemed to influence more of the properties of the flours and cookies than varying the ratio of starch:amylodextrin.

97 pages. $2.00. Mic 58-4316

JOURNALISM

LIBERALISM, DEMOCRACY AND THE MASS MEDIA

(Publication No. 25,233)

Jay Walbourne Jensen, Ph.D.
University of Illinois, 1957

Classical Liberalism is an individualistic Weltanschauung derived from Greco-Roman-Christian philosophy, the Renaissance, Reformation and Enlightenment doctrines of man, and the astro-physical world-view of the Age of Reason. Its central concept is an image of the rational, moral and autonomous Self having reality and meaning in relation to a transcendent order of Reason and moral law, and limited in the exercise of its will only by "right reason" and individual conscience.

The Weltanschauung of Classical Liberalism provided the philosophical ground for the Liberal theory of the press, the main elements of which are the concept of an atomic Self, the philosophy of Jusnaturalism, a negative and individualistic theory of freedom, a belief in a transcendent order of Truth, and the doctrine of a "self-righting process" operating in the free and open marketplace of ideas and opinions.

The rise of Liberalism was marked by the ascent to historical consciousness of the Liberal concept of the Self, its decline by the ascendance of Neo-Liberalism's image of the Self as having reality and meaning only in the collectivity of Culture and in relation to other culturally determined Selfs.

Ascending to the heights in the nineteenth century, the premises and institutions of Liberalism were at the same time being undermined by new modes of thought and changing sociological conditions. Industrial capitalism, nationalism, imperialism and the rise of urban, mass societies

created world-wide conditions inimical to the Liberal Weltanschauung and style of life. Positivism, Romanticism and Collectivism, combined with the revolutions in biology and physics, so altered the world-view of Western man that the ultimate demise of Classical Liberalism is insured and the transformation of the Liberal theory of the press has already begun.

The mass media have been shaped primarily by the rise of mass democracy, industrialization, urbanization, the creation of mass markets, and the development of modern advertising. As the political economy is decisively ordered by the mass character of our industrial culture, so are the content, range and objectives of the mass media.

Today, the Liberal theory of the press is a theory in crisis. The "natural right" of free expression is more and more taken to be a permissive, social right. The individual, personal right to speak is collectivized as the public right to hear. The State, held in fear and contempt by Classical Liberalism, is regarded by Neo-Liberalism as both protector and promoter of the freedom of the press. Whereas the press was once a direct expression of individual will and took the form of the imposition of the Self upon the cultural order, the mass media are primarily concerned with indulgence of the masses and have become adjuncts not of individual wills, but of dominant institutional orders.

The objective function of the media is no longer mainly to facilitate the self-righting process in a free and open marketplace of ideas and opinions, but to mask the realities of the political, social and economic order with the symbols of conformism and by propaganda and diversion to guarantee the loyalty of the masses to the cultural order.

The two stars of the Liberal crown--Reason and the Individual--have fallen into ignominy. Their restoration urgently requires a new Liberal metaphysics postulating an image of the Self as ontologically independent of Culture and existentially related to an immanent or transcendent order of universal Reason. Only thus can Liberalism be grounded in enduring principles that will insure the freedom of the Self, of public communication, and of public opinion. 358 pages. $4.60. Mic 58-4317

ATTITUDE CHANGING EFFECT OF VERBAL AND NONVERBAL ELEMENTS IN SELECTED NEWS AND PHOTO COMBINATIONS

(Publication No. 25,381)

Reuben Mehling, Ph.D.
Stanford University, 1957

This study grew out of the realization that almost no research has been done to determine the attitude changing effect of newsphotos as used in news publications. This is especially noteworthy in view of the extensive use of nonverbal photographic material in the printed news media of mass communication and the repeated survey findings that more newspaper readers look at such photographic matter than at the purely verbal news matter.

By virtue of this large number of readers of pictorial matter, if no other, the nonverbal photographic material should be an important contributing factor to attitude change, if the printed news media have any influence whatever in changing readers' attitudes.

This dissertation reports on a research project investigating the relative attitude changing effect of both verbal and nonverbal elements in news and photo combinations as they would appear in the average news publication.

An experimental design was developed to test attitude change under three conditions: 1) as the result of verbal communications -- news stories; 2) as the result of verbal-and-nonverbal communications -- newsphotos with captions; and 3) as the result of nonverbal communications -- newsphotos of two persons, without captions.

The study leans heavily on the work of Charles E. Osgood, both in the use of the "semantic differential" as a means of measuring attitudes and in the use of the "congruity principle" in predicting changes in attitudes.

One hundred twenty-two subjects received individual booklets in which they were asked to rate sources, i.e., prominent personalities well known to the general news reader, and concepts, i.e., controversial issues in the news, on semantic differential scales. This was called the pre-test.

One week later all subjects received a post-test consisting of the same booklet, except that on the page immediately prior to the rating scales for a source and concept, the subject was exposed to a simulated news communication in which the source made some assertion regarding the concept. These communications appeared in one of the following three forms: 1) a headline and lead paragraph of a news story, 2) a newsphoto with overline and underlines, or 3) a newsphoto without captions showing two identified persons.

These communications were rotated in the booklets according to a balanced design so each subject was exposed to one source-concept pair under each of the several conditions of communication to be tested.

Subjects' pre-test and post-test ratings were tabulated and changes in ratings from the first to the second test were analyzed and tested for significance.

The results of this investigation were as follows:

1. When the same communication was presented in the form of a newsphoto with captions (verbal and nonverbal stimulus) and in the form of a news headline and lead paragraph (verbal stimulus), such predicted changes in attitude as resulted from subjects' being exposed to the two communications were greater for the stimulus which was both verbal and nonverbal than for the stimulus which was verbal only.

2. When a communication was presented in the form of a newsphoto without captions (nonverbal stimulus) wherein two oppositely-evaluated persons were perceived as showing acceptance of each other, changes predicted by the congruity principle took place in attitudes toward both persons pictured. 177 pages. $2.35. Mic 58-4318

AN EVALUATION OF THE METHOD AND CONTENT OF ADVERTISING AND JOURNALISTIC MANAGEMENT EDUCATION AT THE COLLEGE LEVEL

(Publication No. 24,925)

Jack Zanville Sissors, Ph.D.
Northwestern University, 1957

This study concerns a method by which administrators of Journalism schools can evaluate the effectiveness of the curriculum in advertising and journalistic management. It is the hypothesis of the author that the curriculum can be effectively evaluated if an intensive study is made of graduates' opinions and attitudes about their education in the subjects of advertising and journalistic management.

The specific purposes of the study were: (1) to create an instrument which can be used to evaluate the curricula in advertising and journalistic management at the college level, and more particularly in Journalism schools; (2) to test the instrument by applying it in evaluating the method and content of the advertising and journalistic management sequence of the Medill School of Journalism, Northwestern University; (3) to determine as a result of the test, whether or not the instrument is practical and valid; (4) to acquire, as a secondary purpose, pertinent vocational information which can be used to more effectively counsel and guide students majoring in the field.

The method used to sample graduates' attitudes was to mail questionnaires to all graduates of the advertising and journalistic management sequence of the Medill School of Journalism from the years 1940 to 1955. The usable sample consisted of 127 returns.

A brief resume of results showed that:

(1) Respondents rated the value of Medill degrees highly in helping them achieve success and in helping them obtain their first jobs.

(2) The content of courses in advertising and journalistic management and liberal arts were also highly rated. Relatively few courses were considered to be of doubtful value. Furthermore, respondents listed many courses they would like to have taken because they felt such courses would have helped them on their present jobs.

(3) Teaching methods received very high ratings, with Field Trips, Discussion Sessions, and Field Research receiving the highest individual ratings. The faculty of Medill was considered very competent.

(4) Respondents felt that the best way to educate students for the fields of advertising or journalistic management was to have a program of study equally divided between liberal arts courses and technical and professional courses.

(5) It was found that most male graduates entered manufacturing and newspaper advertising departments and advertising agencies. Most female graduates entered advertising agencies, department store advertising sections or newspaper advertising departments. The most frequently performed jobs of all graduates were advertising copywriting and selling. Graduates with Master of Science degrees tended to earn higher salaries than those with Bachelor of Science degrees.

It was concluded that graduates had strongly favorable attitudes toward the curriculum with few exceptions. The questionnaire was found to be weak because it required respondents to give their names. It was felt that a larger percentage of responses might have been obtained if graduates had been allowed to remain anonymous. Furthermore, the rating scales should have had more items on the scale. Finally, explanations were needed to clarify some questions for respondents. In all other respects the methodology was found to be satisfactory.

It was suggested that this method of evaluation is potentially an excellent means of obtaining objectivity. More research was recommended to determine the following: (1) how broad the scope of studies in advertising and journalistic management should be; (2) whether certain low rated courses and methods of instruction need revising, replacing or eliminating. Finally it was suggested that graduates evaluate the curriculum immediately after graduation and again at a later time in order to learn the extent of changes in attitudes.

210 pages. $2.75. Mic 58-4319

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

THE SANITY OF DON QUIXOTE: A STUDY IN CERVANTINE DECEPTION

(Publication No. 23,126)

Dalai Brenes, Ph.D.
Cornell University, 1957

In the numerous exegetic writings on the Quijote two well defined tendencies exist: to present interpretations based on the assumption that Cervantes was a conforming, unquestioning Catholic whose work was completely orthodox or interpretations which view Cervantes as one of the heterodox and his novel as an Erasmian attack on the Church. To date neither side has wholly proved its point and both have disproved important segments of the opposing contention; both agree in regarding Don Quixote as a madman.

Remembering the fact that Cervantes gave his novel the title of El ingenioso hidalgo Don Quixote de la Mancha and bearing in mind the Golden Age meaning of ingenio and ingenioso, especially as explained and defined by Doctor Juan Huarte de San Juan in his Examen de ingenios para las ciencias, Baeza, 1575, of which there were seven editions up to 1603, it is easily seen that the Manchegan is not a madman, but on the contrary a man de muy subido ingenio. The intermittent and short lived moments of madness in Don Quixote are the results of the needs of Cervantes the writer and not the outcome of the mental

derangement of the knight. For a similar reason Gargantua is a giant for rather limited periods in the Pantagruelian chronicle, the rest of the time he is a man among men.

The Quijote is not an attack on the books of chivalry. It appears to be such because what Cervantes is questioning is the claim to historical validity made for the Scriptures and for the Church tradition. The criteria with which the Canon proves to Don Quixote that the books of chivalry are false have the same devastating effect when applied to the Scriptures. The Quijote, however, is far more than an attack and a negation: it is a call to live the good life of right action, a life inspired and given direction by high ideals. Don Quixote abandons the quiet of his library for the hard life of action guided by the high ideals of chivalry. The ideals themselves have a worth and a validity wholly independent of the worth or the validity of their source. The ideals are significant guides to the good life because they lead to magnificent goals and not because the books of which they are the priceless jewels are chronicles of historical events.

Some scholars who see in the Quijote a work of Catholic orthodoxy reason somewhat along syllogistic lines: The Counter-Reformation was a Catholic movement, the baroque is the art of that movement, the baroque is then Catholic art, the Quijote is a baroque work, it has to be a Catholic work. Unfortunately for this reasoning, a close analysis and examination fails to discover any meaningful definition of the baroque which excludes non-Catholic, non-Counter Reformation, non-baroque works and at the same time includes the Quijote. The term baroque turns out to be little more than an impressionistic concept. It is useful only on a level of discourse which does not demand a rigorously disciplined approach with undeviating adherence to a strict terminology consistently used. Baroque is similar to other chronological expressions on the order of "post-War."

249 pages. $3.25. Mic 58-4320

A REINTERPRETATION OF KING LEAR

(Publication No. 23,435)

Sarah Patricia Flanagan, Ph.D.
Brown University, 1957

King Lear, one of Shakespeare's greatest tragedies, was produced at Whitehall in 1606. Critical appraisal of the play, diverse and ambiguous, has created theories that the play is too tragic, or unstageworthy, or improbable, or centered in the lesser characters. Philosophical and aesthetic criticism exiled the play to academic consideration; psychological analysis found in it evidence of the author's perturbation; historical criticism related the play to the age, to the stage, to the sources of the plot; imagistic study discerned in the conflict of good and evil a pattern of "decomposition".

The meaning of tragedy to the author may be deduced from the variations of his tragedies written in the era in which Lear was created. The sources and the author's manipulation of the story are indicative of his intention and interpretation. The theory that King Lear is debased in staging has created problems in criticism. The stage history of the play demonstrates that classical and romantic theories have influenced performances; yet the problems of production do not negate the fact that the play was written for the stage and must be judged in the light of that fact.

To accept King Lear as a poetic drama, retelling an accepted myth, at a moment of high seriousness in history, would seem to reestablish the play. Limited by genre and by the age and stage of Shakespeare, Lear assumes proportions. The improbabilities of the first act, the inevitability of the final tragedy, the occasionally static quality of the characters are logically explained by the rubrics of drama. Interpretation becomes possible. Resemblances to Greek tragedy have been noted, especially to those surrounding the legend of Oedipus. Another parallel may be observed in the Moral plays, in which abstractions had been endowed with personality and in which the essential struggle had been man's wresting salvation from the vicissitudes and defeats of life.

166 pages. $2.20. Mic 58-4321

THE THEORY OF COMEDY IN THE RESTORATION AND EARLY EIGHTEENTH CENTURY

(Publication No. 24,905)

Benjamin Munroe Hazard, Ph.D.
Northwestern University, 1957

Though the comedies of the Restoration and early eighteenth century have been the subject of exhaustive study from many different points of view, little attention has been given to the critical theorizing of the period on the subject of comic drama. A study of the critical writings on comedy between 1660 and 1722 reveals the existence of certain fundamental issues concerning which there was a good deal of lively disagreement. In terms of the purposes of comedy, there was a division of opinion over the question of whether the end of comedy was primarily instruction or pleasure. On the subject of instruction in comedy, there was debate over whether comedy should instruct only by showing ridiculous types or whether it should achieve its didactic end by presenting virtuous figures along with vicious characters. As regards the pleasure function of comedy there were basically two schools, one of which considered that the pleasure was to be derived primarily from the subject matter itself, and the other of which maintained that the pleasure arose chiefly from the brilliant handling of subject matter in witty and elegant language. In connection with the whole debate on the question of pleasure, the subject of the origins and implications of laughter as a human phenomenon was given careful study based largely upon Hobbes' discussion of laughter.

In consideration of the methods of comedy sharp disagreement arose between those theorists who supported humor as the principal basis for comedy and those who considered that it should primarily be based upon wit. Certain modifications of the Jonsonian humors theory were made in the period, but fundamentally the humorists grounded all their theories upon the basic principle of varied and carefully distinguished character delineations. The wit-writers, on the other hand, carrying on a modified version of the Elizabethan rhetorical tradition, conceived of comedy as consisting largely in the brilliant and

witty use of language and the depiction of only such characters as might be considered to conform, or not to conform, to a very limited social code.

In many ways the development of sentimentalism can be seen as a logical projection of the fundamental tenets of the humorists. The humors theory was aesthetically far stronger than wit theory and absorbed the best from wit theory rather than giving way to it. The humorists' insistence upon the value of positive instruction and realistic delineation of character had strong influence upon the development of comedy toward sentimentalism. Wit itself, as the writers of comic drama used it, came to be increasingly under suspicion both as a means of expression and as dangerously anti-social. At the same time, the growth of an optimistic attitude toward mankind tended to soften the feeling of scorn expressed toward the humors character, and to bring about an attitude which considered him no longer as an object of derision but rather as a lovably eccentric figure. Many of the critics were aware that comedy was losing its satiric sting; some of them fought vigorously against the tide. In spite of the fact, however, that Restoration comedy continued to be popular on the stage in the early years of the eighteenth century, the comic forces which had produced it declined, the brilliance of satiric wit softened, and for the scornful laughter of the true homors comedy was substituted the kindly smile, the sympathetic understanding, and the pictures of positive virtue which went to make up sentimental comedy.

195 pages. $2.55. Mic 58-4322

The Bayān al-Farq bayn al-Ṣadr w-al-Qalb w-al-Fu'ād w-al-Lubb of al-Ḥakīm al-Tirmidhi: (edited and translated by Nicholas Lawson Heer)

(Publication No. 20.121)

Nicholas Lawson Heer, Ph.D.
Princeton University, 1956

This thesis consists of a critical edition and translation of the Bayān al-Farq bayn al-Ṣadr w-al-Qalb w-al-Fu'ād w-al-Lubb of abu-'Abdallāh Muḥammad ibn-'Ali al-Ḥakīm al-Tirmidhi. The edition is based on the unique MS of this work found in the Dār al-Kutub al-Miṣrīyah in Cairo and catalogued as taṣawwuf 367.

The Bayān al-Farq is a psychological description of the heart (qalb) and the four concentric layers contained within it. Each of these layers is related to one of the lights of God. Thus the breast (ṣadr), or outer layer, is related to the light of Islam (nūr al-Islām), the heart proper (qalb), which is within the breast, is related to the light of faith or belief (nūr al-Īmān), the inner heart (fu'ād), the third layer, is related to the light of gnosis (nūr al-ma'rifah), and the inmost layer, the pith (lubb), is related to the light of unification of God (nūr al-tawḥīd).

These four layers also correspond to the four spiritual degrees of the Ṣūfi, i.e. the muslim, the believer (mu'min), the gnostic ('ārif), and the unifier (muwaḥḥid), and to the four different states of the self (nafs) mentioned in the Qur'ān, i.e. the self which exhorts to evil (al-nafs al-ammārah bi-al-sū'), the blaming self (al-nafs al-lawwāmāh), the inspired self (al-nafs al-mulhamah), and the peaceful self (al-nafs al-muṭma'innah).

In the introduction to the edition the sources for al-Tirmidhi's life are described as well as his connections with the Malāmati school of Ṣūfism. A more complete and exact listing of his works than that given by Brockelmann is presented and the influence of some of these works on later authors such as al-Ghazzāli and the ibn-Qayyim al-Jawzīyah is pointed out. 166 pages. $2.20. Mic 58-4323

THE POEMS OF WILLIAM DUNBAR: A DESCRIPTIVE AND CRITICAL ANALYSIS

(Publication No. 23,448)

Colin Edward MacKay, Ph.D.
Brown University, 1957

The accompanying dissertation presents a detailed descriptive and critical analysis of the poetry of William Dunbar (1460? - 1520?).

The study begins with a brief summary of the poet's reputation from his own time to the present. Next, by way of further introduction, the necessary background, both biographical and historical, is considered. In the case of the Life, the main purpose has been to stress the relatively few facts available about Dunbar's career and, correspondingly, to place the mass of mere suggestions and suppositions in their proper perspective. For background, only the high points of Scottish history from Dunbar's birth to his death have been considered; any concentration has been on presenting a view of the court and the character of Dunbar's royal patron, James IV, as these might be considered influences on the poetry.

The poems themselves have been divided into four major groups, determined essentially by subject matter. The groups are: Petitionary and Personal Poems; Religious and Moral Poems; Poems of Love and Women; and Poems of Town and Court Life. In each group, the more famous and artistically successful poems have naturally received extra attention, but no poem safely attributable to Dunbar has been omitted in the discussions. The arrangement of the poems in each major unit has been determined solely by the possibility of presenting effective contrasts and comparisons.

The dissertation proper concludes with a detailed discussion of Dunbar's Poetics. Special attention is given to his prosody, his imagery, the nature of his literary allusions, the nature of his humor and satire, his use of abstractions, and, finally, his command of different levels of language.

There are four appendices: one on the problems of dating the poems; one on the chief original sources of the poems; and one on poems of dubious authorship, the latter an attempt to establish a canon. The concluding appendix offers a table of Dunbar's varied verse forms.

209 pages. $2.75. Mic 58-4324

MILTON'S CONCEPTION OF ORIGINAL JUSTICE AND OF ORIGINAL SIN

(Publication No. 22,934)

John Franklin Murray, S.J., Ph.D.
The University of New Mexico, 1957

Chairman: Assistant Professor Norton Barr Crowell

Milton's understanding of original sin is considered by some modern critics to be the central problem of Paradise Lost. A few, seeking adequate motivation for the Fall, recognize Adam and Eve as fallen before the Fall, an expedient to make the transgression credible. Others, in trying to determine the theme of Paradise Lost, conclude that Milton's rejection of total depravity in human nature is evidence that he abandoned altogether the idea of hereditary sin.

This study examines Milton's theology of innocent and fallen human nature, particularly in the epic, by comparing it systematically with both the traditional and the reformational theology of original justice and original sin. Milton's thought, obviously complex because eclectic, is further obscured by shifts in position and by adaptation of theological abstractions to artistic needs. However, the classical attributes of the state of innocence — immortality, impassibility, infused knowledge, integrity, and the Divine Image — are all discernible in varying degrees in Milton's Adam and Eve before the Fall. After the Fall these are sharply modified, and human nature is shown as permanently affected. The determination of the nature and degree of these changes makes the theme of Paradise Lost more intelligible and, accordingly, any evaluation of Milton's artistry more accurate.

The conclusion of this study is that Milton's innocent Adam and Eve, though more prone to human frailty than orthodox theology permits, were probably not depicted as fallen to make their transgression credible. Further, Milton's humanistic insistence on Right Reason and Free Will in man rather than on total depravity in his nature does not constitute an abandonment of the traditional conception of original sin. Milton's faith in the natural man is not necessarily Pelagian. It is rather a partial reversion to the traditional Augustinian and Thomistic positions.

370 pages. $4.75. Mic 58-4325

THE CHAIN OF SIN AND PRIVATION IN ELIZABETHAN LITERATURE

(Publication No. 25,387)

James Louis Rosier, Ph.D.
Stanford University, 1957

The principle aim of this study is to trace the emergence and development of two ideas -- the chain of sin and privation -- in the theology and literature of Elizabethan England. An introductory chapter investigates the sources of these concepts within the context of mediaeval theology, and attempts to explain and define them as precisely as possible, especial emphasis being placed upon the writings of Augustine and Aquinas as sources for them. Next, the same ideas are analyzed in more detail as they appear in the theological treatises and homiletic literature of Elizabethan England, and some attention is paid to the way in which they were developed and supplemented by the commentators and preachers, and to the extent to which they became commonplace. The views held by both Anglicans and Puritans are included in cross section, although stress is placed upon the widely-read works of the two foremost Puritan preachers, William Perkins and Richard Sibbes, and on the sermons of John Donne. This examination of the treatments of the chain of sin and privation as they appear in avowedly religious writings leads, in turn, to a consideration of their appearance in writers whose main interests were literary but who explicitly shared the general interest in theology. A minor devotional treatise by George Gascoigne and a well-known historical romance by Thomas Lodge are treated as examples.

Once the conceptions of the chain of sin and privation have been traced to their sources and shown to be commonplace in the religious writings of the period and to have been used in detail by two typical writers, the more important part of the study follows -- that is, a critical analysis of the 'psychology of sin' as it informs the poetry and drama of Elizabethan England. No attempt is made to catalogue all references to the ideas involved, although they occur frequently. Rather, a few works have been selected which best illustrate how the ideas were employed by writers as organizing principles of thought and of poetic or dramatic structure. Chapter IV treats the poets Fulke Greville, Robert Southwell, Sir John Davies, and George Wither. Chapter V discusses the chain of sin as an organizing principle both in one of the popular homiletic tragedies, A Warning for Fair Women, and in Marlowe's Doctor Faustus. Finally, chapter VI observes the appearance of Shakespeare's interest in the problems of evil and sin in two of his earliest plays, Richard III and Titus Andronicus, and, in contrast, his most vigorous treatment of these problems in Macbeth.

This study of the influence of the chain of sin and privation on Elizabethan literature has three results. First, it should increase our understanding and appreciation of some of the significant achievements of the English literary heritage. Secondly, a detailed comprehension of these ideas should provide some new insights into the Elizabethan view of man and the universe. Lastly, it should make it possible to add the "chain of sin" to the persistently expanding vocabulary of Renaissance ideas which students of English literature now use in critical exegesis and evaluation. Such ideas as "the divine right of kings," "passion psychology," the order of Nature," etc., are a part of any study of the age. While no one of these ideas provides an arbitrary explanation of any aspect of the "Elizabethan world picture," all of them do provide helpful signposts to guide us in understanding that picture. "The chain of sin" is one of the more important of these signposts, because it summarizes a valuable view of the nature of man as part of a universe ordered by divine law.

240 pages. $3.10. Mic 58-4326

EMERSON'S ENGLISH TRAITS: A CRITICAL AND ANNOTATED STUDY

(Publication No. 25,184)

John Warren Smith, Ph.D.
The University of Texas, 1957

Supervising Professor: Joseph H. Jones

The purpose of this dissertation is to provide an annotated edition of Ralph Waldo Emerson's English Traits (1856) to elucidate the many allusions Emerson made to history, literature, religion, art, economics, etc., spanning English history from pre-Christian days to the mid-nineteenth-century. The first edition text (Phillips, Sampson and Company, Boston, 1856) is included, with the paragraphs numbered in order to facilitate reference.

Preceding the numbered text of English Traits is an Introduction which orients the book to the large body of travel literature of the early nineteenth century. Captain Basil Hall's Travels in North America (1829), Frances Trollope's Domestic Manners of the Americans (1832), Harriet Martineau's Society in America (1839), and Charles Dickens's American Notes (1842) are discussed as representatives of the English side of the English-American culture controversy. Washington Irving and James Fenimore Cooper reflect the American viewpoint (which was represented by a smaller group of writers than the English) in the travel literature of the time. The works of these authors are shown to have contributed largely to the tradition of travel literature, of which English Traits was the culmination. Emerson's work is shown to be the well-balanced scholarly and psychological study of England which these earlier books failed to provide.

The response to the publication of English Traits as manifested in the periodical literature of Britain and America is reviewed. Various editions and the translations into foreign languages are considered.

Finally, an evaluation is made in terms of the author's stated purpose, the author's qualifications for writing such a work. the relation of the book to the body of Emersonian literature, and the comparative quality of the book.

629 pages. $8.00. Mic 58-4327

LANGUAGE AND LITERATURE, CLASSICAL

PAIRED EXPRESSIONS IN HOMER

(Publication No. 25,221)

Norman Frank Gienapp, Ph.D.
University of Illinois, 1957

This dissertation is an evaluation of a feature of Homeric style involving the combination of two or more words or sentence elements, frequently joined by conjunctions, less often in asyndeton. In its widest aspects this stylistic feature includes clauses and entire sentences. However, this study is for practical purposes confined to pairs or groups of nouns, adjectives, and verbs. Some examples are menos kai tharsos, kalos te megas te, anistato kai meteeipe. The study first makes a comparison with a similar stylistic device in Virgil; second, it presents a metrical analysis of the use by Homer of selected words in paired expressions.

The comparison between Virgil and Homer is on the basis of Aeneid i, 1-444, and Odyssey i. Comparison is drawn on the basis of the frequency of occurrence, the number of elements employed, the number of lines occupied, the parts of speech most frequently combined, the logical relationships of word-pairs, the tendency toward repetition, and the tendency toward repetition in fixed metrical positions. Less significant differences encountered include Virgil's use of paired expressions with twice the frequency of Homer, Virgil's infrequent use of adjective combinations, his avoidance of combinations of nearly synonymous words, his readiness to use paired expressions more extensive in the number of elements and the portion of text occupied by them, and his frequent use of combinations of verbs with separate objects. The most striking observations, however, are that Homer repeats paired expressions more often than Virgil, and that Homer repeats them more often in fixed metrical positions.

This observation prompts the second part of the study, where this tendency of Homer toward repetition in fixed metrical positions is analyzed. Selected words among those occurring most frequently, including twenty nouns, ten adjectives, and ten verbs, are examined in all of their occurrences in the Iliad and Odyssey. Each word is examined to see how often it occurs in paired expressions, how often these expressions are repeated, and repeated in fixed metrical positions. With each word is outlined the evidence for the number and kind of paired expressions in which it occurs and the metrical positions it assumes.

This part of the study produces evidence that paired expressions possess a high degree of metrical utility, i.e., they are frequently repeated in fixed portions of the line before and after the main caesuras. Paired expressions are thus shown to be formulaic in character and therefore deserve to be included among those formulas and formulaic systems whose presence has been adduced to prove the oral composition of the Homeric poems.

At the same time, however, this study has produced evidence that paired expressions are used with conscious thought and artistry. It is shown that paired expressions are adaptable, by addition of medial words and by changes in the form and position of connectives, to a variety of metrical situations. It is also shown that paired expressions are not always used when a given metrical situation would make their use possible, but that the single elements of the combination are used alone at that point, for no apparently cogent reason except that the poet here consciously chose a different form of utterance than paired expressions. Therefore, while the evidence in the main supports the claims of those who find in the formulaic speech of Homer proof for the oral composition of the poems, it fails to support extreme claims that he used formulaic materials exclusively, in a primitive artless form of composition, and finds in the use of paired expressions evidence of conscious art and creative genius.

234 pages. $3.05. Mic 58-4328

LANGUAGE AND LITERATURE, LINGUISTICS

FRENCH VOCABULARY INFLUENCES IN SOME THIRTEENTH-CENTURY ENGLISH WORKS

(Publication No. 25,238)

Roy Eugene Lambert, Ph.D.
University of Illinois, 1957

French words and phrases appearing in five 13th-century English texts are counted and analyzed in this study, in an effort to determine how extensive the French vocabulary influence had become before the time of Chaucer.

The texts used are Morton's edition of the Ancrene Riwle; McKnight's edition of Floris and Blauncheflur, King Horn, and the Assumption of Our Lady; and Wells' edition of the Owl and the Nightingale. For each of these, two counts have been taken. The first consists of the total number of French loan-words which appear; the second of the total number of times these borrowings occur, counting repetitions. The results are summarized below.

	Number of Words:	Number of Borrowings	Total appearances of borrowings	Frequency
Ancrene Riwle	63,955	525	1,988	1 in 32
Floris and B.	8,125	211	380	1 in 22
King Horn	3,822	123	200	1 in 19
Assumption	5,418	96	236	1 in 23
Owl and N.	10,800	49	69	1 in 157

The body of the dissertation is devoted chiefly to an analysis of the individual French words found in each text, and primarily to a discussion of the words which show some peculiarity of development, either in becoming English (i.e., in passing into Anglo-Norman, and thence into Middle English) or in becoming French (i.e., in passing from Latin into Old French, and thence into Central French). Most "peculiarities" are shown to be the result of Norman dialectal influence on the one hand, or of non-popular (chiefly learned) influences on the other.

The works cited above are discussed in the order listed. Chapter one is devoted to the Ancrene Riwle, a religious and didactic prose work. Part of this chapter is taken up with a discussion of the characteristics of Norman and Anglo-Norman, which play a large part in shaping the French word-forms adopted in English. (In the Ancrene Riwle, for example, the vast majority of French borrowings are taken into English in their Norman dress). Chapter two considers the romances Floris and Blauncheflur and King Horn, both poetic in form. The chapter points out that although the former is a near-translation from French, while King Horn is a native tale, the proportion of loan-words in the first is lower than that in the second. Chapters three and four are concerned with the Assumption and the Owl and the Nightingale, respectively; poems both, although the first is a religious lai; the second a debat. French borrowings in the first are relatively numerous; in the second, for reasons which are not clear, the loan-words are few, but those which do appear are often in the form of hybrids, indicating that the French vocabulary additions had long since been accepted and naturalized. Finally, chapter five discusses such miscellaneous aspects of French vocabulary influences as phrase patterns, hybrid forms, and doublets.

The conclusions drawn in the final chapter include the following: (1) French vocabulary influence was stronger in the 13th century than has been commonly supposed; (2) that influence was widespread, being manifested in prose as well as poetry; native tales as well as romances; (3) of the two channels through which French borrowings flowed into English during this period, Norman French was the more important. Central French assumed a predominant role in the 14th century, with the advent of Chaucer, but in the 13th century, the "French vocabulary influence" analyzed in this paper was primarily Norman.

262 pages. $3.40. Mic 58-4329

A HISTORICAL STUDY OF THE SPANISH SEGMENTAL PHONEME SYSTEM

(Publication No. 25,173)

Julius Oswald Purczinsky, Jr., Ph.D.
The University of Texas, 1957

Supervising Professor: Ernest F. Haden

This is a historical study in which structural and descriptive principles have been followed. Although the field of investigation is necessarily diachronic, it has been possible to treat the material synchronically by breaking it up into a series of phonemic systems appearing at different points in time. The linguistic phenomena are treated in terms of a series of sound structures, that is, as functioning within a given structure at a given time; and those changes which occur are considered as changes in structure.

The segmental phoneme system of Proto-Ibero-Romance (PIR), a linguistic stage preceding the development of the Ibero-Romance languages, is reconstructed. The method used is the comparison of the three Ibero-Romance languages: Portuguese, Spanish, and Catalan. All results have been obtained by reconstruction and are expressed in phonemic and structural terms. The development of the Old Spanish and Spanish segmental phoneme systems from the PIR system is then traced. A separate chapter has been devoted to the diphthongization, in Spanish, of open e and open o.

From the reconstruction of PIR, certain conclusions can be drawn. (1) The limitation of the number of consonant phonemes capable of occurring as syllable-final, which characterizes modern Spanish, was shared by the PIR system. In other words, the phenomenon of neutralization of contrasts between consonant phonemes in the distensión silábica is reconstructed for PIR. The number of possible contrasts in that position is smaller in PIR than in Spanish. (2) Vowel length appeared in PIR as allophonic in all stressed syllables, whether checked or free. (3) Those changes which characterize the Spanish segmental system, in contrast with the PIR system, can be

better understood in terms of the PIR system and its distribution. (4) There has been a general tendency to shorten the duration of the syllable.

213 pages. $2.80. Mic 58-4330

A DIALECT STUDY OF SAN ANTONIO, TEXAS: A BILINGUAL COMMUNITY

(Publication No. 25,178)

Janet Beck Moseley Sawyer, Ph.D.
The University of Texas, 1957

Supervising Professor: Dr. E. Bagby Atwood

This study was conducted for the purpose of contributing to the survey of the dialect areas of the United States which was begun in the East under the supervision of Professor Hans Kurath. The survey of Texas and the surrounding areas of the Southwest is now under way under the supervision of Dr. E. Bagby Atwood of the University of Texas. The methods used in the Linguistic Atlas of the eastern states have been followed in this survey.

In this survey seven native English-speaking informants and seven informants of Spanish-speaking background were used. Much of the material in the dissertation is concerned with comparisons between the two groups in their use of English.

Chapter I presents the history of the community and explains the methodology of the survey. Chapter II presents the pronunciation of the seven Anglo speakers, then the pronunciation of the Latin speakers, with an analysis of the particular features of English which are found to be difficult for them. Chapter III contains an analysis of the vocabulary, pointing out (1) the regional forms which are typical of dialect areas in the East; (2) the vocabulary which is typical of Texas and the Southwest; (3) words which are obsolescent in the urban area; and (4) a comparison between the Latin and Anglo vocabulary. Chapter IV contains a summary of the inflexional forms used by the informants. Chapter V presents a summary and evaluation of the results of the survey; and Chapter VI gives a complete listing of the work sheets with the responses of the individual informants in inventory form.

It was found that the speech of the Anglo informants of San Antonio is very representative of the Southern element of the early settlement groups. Evidence is found in such features as: (1) the "vocalized /r/"; (2) the diphthongal /æ y/; (3) the monophthongal "long i": [a.] in five; (4) the diphthongal /ɔw/; (5) [I] in certain unstressed syllables: Dallas, wanted; (6) /iw/ after /t/, /d/, /n/: tune, due.

The lexicon of the San Antonians is also strongly Southern, but has been greatly influenced by the rapid urbanization of the community. Modern city life has caused a wide gap between the vocabulary of the city dwellers and the older members of the community who have a rural background.

The difficulties of the Latin informants in acquiring the English of the region are analyzed in detail. These include such difficulties with segmental phonemes as the use of [i] for /I/, of [s] for the /z/ phoneme, etc. The placement of stress is also shown to be a major difficulty.

In general the Latin informants lack the older regional words which might be expected to be acquired in the home. Their main problem seems to be one of acculturation, that is, the elimination of social barriers.

331 pages. $4.25. Mic 58-4331

LANGUAGE AND LITERATURE, MODERN

FIVE ENGLISH ROMANTICS AND NAPOLEON BONAPARTE

(Publication No. 23,814)

Nelson V. Davis, Ph.D.
Princeton University, 1957

In examining the attitudes toward Napoleon Bonaparte expressed by Scott, Wordsworth, Coleridge, Hazlitt, and Byron, it is possible to show several basic facts about the political thinking and personal philosophy of each man. Such thinking is of particular interest as it reflects certain characteristics of Romanticism, especially Romanticism's view of the role of government in the affairs of men.

Wordsworth began as a liberal, hopeful for the achievement of the goals of the French Revolution. But as the Revolution failed, Wordsworth began to shift his position, and the rise to power of Napoleon further goaded him toward conservatism. He now developed the idea that just government could not be achieved by the principles of revolution, or by a strong leader. Instead, he believed that mankind could accomplish true freedom only through an inner moral development, stronger than Napoleon's armed force. Thus far, Wordsworth was right, but he unfortunately fell victim to the hysterical anti-Bonaparte sentiment of his day and assumed a reactionary position which he never abandoned. His main attitude toward Napoleon was a mixture of hatred and disappointment.

Coleridge, too, ran a course from revolutionary youth to reactionary old age. Though never quite so enthusiastic as Wordsworth about the Revolution, he became a much more vitriolic hater of Napoleon. Never what might be called a practical man, and much immersed in the abstractions of metaphysics, he attempted to judge Napoleon on abstract moral principles. He failed, largely because he allowed himself to become too preoccupied with trivia; often he descended to mere quibbles over words. Once convinced of his rightness, he was the most vindictive of the writers, except for brief flashes of his former insight. When he abandoned Napoleon, he did so whole-heartedly.

Of the five writers, Scott was the practical man, uninterested in any but the simplest and most practical moral ideas. Napoleon simply represented to Scott the antithesis of everything he held sacred--his ideas about government, law, and the social order. Moreover, Napoleon's wars disturbed the daily financial functioning of the British Empire. Only when Scott caught a glimpse of Napoleon as a hero from romance was he at all sympathetic. Scott was the only one of the five writers whose view of Napoleon never changed.

Byron always hated kings, and because of Napoleon's great power, Byron at first disliked him. But Napoleon

had also destroyed kings, and Byron began to develop a sympathy for him. Undoubtedly contributing to Byron's shift of opinion was his vision of Napoleon as a man resembling himself: this made Napoleon into another Harold --or Byron. In his later life, Byron had the fairness to admit Napoleon's defects, and like Wordsworth he saw that a high morality was necessary for the achievement of man's hopes; Napoleon lacked this high morality. Unlike Wordsworth, Byron never abandoned his hopes for the creation of popular government.

Hazlitt believed in human freedom and justice. He realized that such ideals had never been and could never be realized under the old system of "legitimate" government. In this respect he resembles Byron and is the exact opposite of Scott. Like the writers of the older generation, Hazlitt, too, was disappointed in Napoleon; unlike them, he continued to think that Napoleon at his worst was better than kings at their best. In his own day he had the reputation of being one who made excuses for everything Napoleon did, but he clearly did nothing of the sort. Actually, Hazlitt was as much aware of Napoleon's defects as any of his contemporaries, but he was more concerned with Napoleon's reactionary enemies than he was with Napoleon. Almost alone, he spoke out against the violent and hateful reaction of his time.

As a personality, Napoleon captured the imagination even of his detractors. His daring, his skill, and his imagination created about him the myth of the superman. He perfectly epitomised Romanticism's spirit of revolt.

455 pages. $5.80. Mic 58-4332

WILLIAM ALLINGHAM: THE IRISH YEARS, 1824-1863

(Publication No. 25,218)

Ronald Edward Freeman, Ph.D.
University of Illinois, 1957

Because the published accounts of William Allingham (1824-1863), particularly in his edited diaries and the selections of letters written to him, present only a partial picture of the man, poet, critic, and editor, a comprehensive study was called for to place Allingham among his contemporaries and against the background of his isolated Irish life. This study is based on hundreds of unpublished manuscript letters, some of them Allingham's own, but principally letters written to him. Allingham the Irish man and poet does not materialize from published accounts. He hid his real self, his ambiguous inner self that wanted fame, success, friendship, and companionship; and the solitary customs official of far-off Ballyshannon overshadows the vibrant personality that delighted the Pre-Raphaelites, Tennyson, Browning, Carlyle, and the aging Leigh Hunt. The purpose of this study of his years in Ireland, therefore, is an attempt to depict his personality, to evaluate the influence of Ireland and literary friendships on the poet, to estimate his poetry in the light of contemporary criticism, and finally to suggest the position of William Allingham in the Irish literary tradition.

The personality of the poet emerges in its eager youthful naïveté in letters to established authors: Leigh Hunt, William Carleton, Samuel Ferguson, and Ralph Waldo Emerson. Through his correspondence he soon became intimate with a younger group of writers and artists: Clough, Patmore, Henry Sutton, and then the Rossettis and the whole circle of Pre-Raphaelites. In these early years, though, his only personal contact with his friends came during a few weeks in London each summer. It was primarily through the pages of his multifarious correspondence that his ideas and poetry became known to these friends. Forty-five of Allingham's letters written to Henry Sutton in the early 'fifties best reveal his personality, for to Sutton he most often bared his soul and wistfully described his dreams and ambitions. The clear portrait that can be extracted from this unpublished correspondence helps explain and interpret other letters of this period written to Allingham.

With only his own native countryside for inspiration and consolation, he maintained two distinct strains in his early poetry. On the one hand, his avid reading of English poetry manifested itself in somewhat brittle and artificial literary pieces with ornate poetic diction. On the other, his proximity to spectacular natural settings--the Donegal mountains, Lough Erne, and the Atlantic Ocean--and his sympathetic understanding of his own village and its inhabitants stimulated him to write idiomatic and musical lyrics in which these settings are depicted with an exact and discerning eye. Some of his best poetry, indeed, was written for his first volume in 1850.

Everywhere acclaimed by contemporaries for his fresh diction, eye for nature, and his choice of homely Irish subjects, he published a second major volume in 1855 with the same type of Irish poetry predominating, which again won the praise of friends and critics. But his remaining Irish years brought forth only infrequent poems, among which, however, were the outstanding "Winding Banks of Erne" and "Abbey Asaroe." Having turned from lyrical poetry, his true bent, to narrative writing, he fumbled ineffectively until he produced "Laurence Bloomfield in Ireland" completed only after he left Ireland permanently in 1863.

Allingham's middle years, the years after his first flush of success, are first described in detail in this study. His extensive correspondence provides clear evidence of his disillusionment, his torpor, his ambitions, and his melancholy. The importance of friends and letters to Allingham cannot be over-emphasized; his need for both accounts in part for the lack of leadership in Irish poetry in the mid-nineteenth century. He was never able to take a completely independent course in his writing.

A year before Allingham's death, William Butler Yeats proclaimed him the "Poet of Ballyshannon." After receiving this praise, Allingham recorded in his diary: "Non-national, how sad." But as the poet of one corner of Ireland, he represented Irish lyricism and native Irish feelings, for he understood what he wrote about when he used Irish subjects. His best poems are melodious Irish lyrics. When he strayed from his musical gift, his poems are pedestrian. His genius was small, but his best efforts are vivid and sensitive, light rather than provocative, rhythmical rather than eloquent. Allingham's friends recognized and sympathized with his desire to be popular, to live in London, and to write profound verse, but they also counseled him to stick to Irish qualities, Irish subjects, where lay his real genius.

428 pages. $5.45. Mic 58-4333

G. B. S. AND GERMANY: THE MAJOR ASPECTS

(Publication No. 25,375)

James Willard Groshong, Ph.D.
Stanford University, 1957

In tracing the relationship between Bernard Shaw and Germany one finds a complex of mutual influences. As early as the mid-1860's he came under the influence of German music, and later, to a limited extent, under that of German philosophy. In turn, after 1902 he became a major influence in Germany as playwright, public figure, and pundit.

As a music critic Shaw championed the composers of German Europe above all others and was especially aggressive in promoting the music of Wagner in England. Attracted by Wagner's revolutionary attitudes in morals and politics as well as in art, he published quantities of Wagnerite propaganda and criticism, including The Perfect Wagnerite, an allegorical interpretation along socialist-vitalist lines, of Der Ring des Nibelungen. Yet as propagandist Shaw was probably of less importance in establishing Wagner's reputation in England than many commentators have supposed. Likewise as Wagner critic he had little permanent influence. In the making of the essential Shaw, however, Wagner's influence was considerable, especially in the formation of the Shavian superman.

Shaw admired bits and pieces of German philosophy which supported his own philosophic bias and made good propaganda; but his knowledge of the works of German philosophers was superficial and fragmentary. He was interested in Schopenhauer and Nietzsche, but his consistent denial of debt to either man seems borne out by the superficial nature of his published references to them; by major differences between his ideas and theirs; and by the fact that the "Schopenhauerian" and "Nietzschean" ideas in his work are readily traceable to other sources.

Shaw's influence in Germany came first by way of his plays. Aided by his German translator, agent and promoter, Siegfried Trebitsch, Shaw became the foremost dramatist on the German stage, and Germany became his most consistently successful foreign market. Even the widespread critical attack on the Trebitsch translations failed to hinder the success of Shaw's major plays -- especially Pygmalion, Candida, and St. Joan -- and most of the minor ones.

His influence in Germany as a public figure and pundit is perhaps best shown by the fact that during World War I he was the English private citizen most frequently quoted and commented on in the German press. Misreading his pronouncements on the war, the Germans and English alike considered him essentially pro-German, chiefly because he was consistently more critical of England than of Germany. This impression persisted in both countries long after the war. Actually he was "pro-German" only in the sense that he stressed his sympathy for the German people and their culture. On the major issues of the war his attitude was that of a socialist-humanitarian.

In summary, Shaw appears to have admired Germany for her culture, for her value as a goad to the British, and perhaps for her favorable attitude toward himself; while Germany admired Shaw chiefly as playwright, Anglophobe, and pundit. 214 pages. $2.80. Mic 58-4334

SPANISH IMITATIONS OF THE CELESTINA

(Publication No. 25,229)

Ernest H. Kilgore Hillard, Ph.D.
University of Illinois, 1957

This dissertation is a study of the principal variations of the Celestina theme in Spanish literature from 1499, the date of the first known edition of the Comedia de Calisto y Melibea, to the arbitrarily selected date of 1650. The twenty-five works which followed the Comedia and were clearly derived from it fall into three distinct groups, viz.: continuations, close imitations, and free imitations.

I. Continuations are works which are formally and explicitly based on the original Comedia. The fifteen-act original was first expanded by the insertion of additional episodes to produce the Tragicomedia of twenty-one acts, and this in turn was expanded to twenty-two acts. These expansions were followed by works which purported to describe actions antecedent or subsequent to the action of the Tragicomedia, and which included characters who were identified either as persons whose earlier or later career had been recounted in the Tragicomedia or as the descendants or successors of such persons.

The principal continuations are:

1. The Tragicomedia de Calisto y Melibea attributed to Fernando de Rojas, 1502.
2. The Tragicomedia with an inserted act by Sanabria, 1526.
3. The Segunda Celestina by Feliciano de Silva, 1534.
4. The Tercera Celestina by Gaspar Gómez, 1536.
5. The Lisandro y Roselia by Sancho Muñón, 1542.
6. The Policiana by Sebastián Fernández, 1547.
7. The Selvagia by Alonso de Villegas Selvago, 1554.
8. The Segunda Celestina by Salazar y Torres (finished by Vera Tassis, 1694).

II. Close imitations are works whose structure parallels that of the original Celestina, but which have no characters in common with that work. These works have at least one pair of lovers, corresponding to Calisto and Melibea, who are brought together by the efforts of an entremetteuse who is the counterpart of Celestina. These are:

1. The Thebayda, anonymous, 1521 (?).
2. The Florinea by Rodríquez Florián, 1547.
3. The Tidea by Francisco de las Natas, 1550.
4. The Salvaje by Romero Cepeda, 1582.
5. La Lena or El Celoso by Alfonso Velázquez de Velasco, 1604.

III. Free imitations are works clearly inspired by the Celestina but not parallel in structure. These are of two types, viz.:

A. Works which have a bawd corresponding to Celestina, but do not have a pair of lovers comparable to Calisto and Melibea. These are:

1. The Égloga de Plácida y Vitoriano by Juan del Encina, 1513.
2. La Lozana Andaluza by Francisco Delicado, 1538.
3. La Hija de Celestina by Salas Barbadillo, 1612-13.
4. La Esquela de Celestina by Salas Barbadillo, 1620.
5. The Sabia Flora Malsabidilla by Salas Barbadillo, 1621.
6. The Celestina (entremés) by Navarro de Espinosa, 1643.

B. Works which have lovers comparable to Calisto and Melibea, but no entremetteuse, the latter's function being usually performed by a servant or servants. These are:

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

1. The Penitencia de amor by Pedro Manuel de Urrea, 1514.
2. The Ymenea by Bartolomé de Torres Naharro, 1517.
3. The Calamita by Bartolomé de Torres Naharro, 1520.
4. The Seraphina, anonymous, 1521.
5. The Ypólita, anonymous, 1521 (?).
6. The Radiana of Agustín Ortiz, 1533-35.

Each of these twenty-five imitations was discussed with reference to (1) publication, (2) author and date, (3) type of composition, (4) type of plot and characters, (5) résumé of plot, (6) moral atmosphere, (7) relation to the Celestinesque tradition, and (8) style and literary value.

The imitations form a considerable body of literature, and some of them have high literary value. Although the works share certain basic conceptions, they show marked contrasts as well as similarities in plot, characterization, and style. The traditional elements do not appear to have impeded the expression of each author's talent and personal view of life. Many of the imitations replaced the tragic ending of the original with a dénouement in which the lovers were united in marriage. Although many imitations present lovers who are in one way or another more attractive or more plausible than Calisto and Melibea, none equalled the original in presenting a bawd who combines corruption and evil with certain human qualities that excite pathos. In moral tone the imitations range from the Lisandro y Roselia, which has a clear didactic purpose, to the unabashed hedonism of the Comedia Seraphina.

Most of the longer imitations exhibit in varying degrees three principal literary defects, viz. (1) a tendency to use type characters, especially in ancillary rôles; (2) a tendency inordinately to complicate the subplot, as in the fifty acts of the Tercera Celestina; (3) a tendency to pseudo-philosophical discourses with displays of erudition or tedious moralizing, as in the Thebayda.

The Celestinesque tradition was variously adapted to the stage by Torres Naharro, De las Natas, and Salazar y Torres, and it was combined with the picaresque narrative by Salas Barbadillo, but the most effective form remained that of the original, a sequence of dialogues not intended for performance.

The number, variety, and quality of the imitations attest the vitality of the tradition inaugurated by the publication of the original Comedia.

479 pages. $6.10. Mic 58-4335

AN ANNOTATED CRITICAL EDITION OF ROJAS ZORRILLA'S PELIGRAR EN LOS REMEDIOS

(Publication No. 23,442)

Fred Wilson Jeans, Ph.D.
Brown University, 1957

This critical edition, the first prepared on the basis of a manuscript even partially in Rojas Zorrilla's handwriting, comprises three sections of approximately equal length —Introduction, Text, and Notes—, followed by a bibliography of the works cited.

Principal emphasis in the Introduction is upon description, analysis and evaluation of all known texts of the play in order to determine their relationships and relative correctness. In shorter sections are presented explanation of the nature of the present edition, summary of the plot, theatrical and critical history of the play, the editor's criticism with discussion of some outstanding similarities to other plays by Rojas, and analysis of the versification in relation to metric tendencies in the other plays of Rojas' two Partes.

The texts studied have been the unique manuscript, preserved in the Biblioteca Nacional, and eight editions, including seven of the seventeenth century. Two rare, undated sueltas often have the same reading as the manuscript by contrast with a different reading in all other texts, and in such cases the manuscript and these sueltas are usually correct. The other editions, on the other hand, are more complete. In this group are the texts printed in the two editions of Rojas' Primera Parte, three undated sueltas very closely related to one another, and the text included in the Biblioteca de autores españoles, LIV. None of the sueltas stems from the manuscript or Rojas' Primera Parte, although the unknown manuscript source of the latter was probably the basis for the earliest of the three closely related sueltas.

The manuscript, signed and dated by Rojas on December 9, 1634, is a stage copy shown by its handwriting to have been emended by Rojas and at least four other persons. Rojas eliminated four folios early in Act II and replaced two folios late in Act III with two others in his handwriting in order to shorten the play primarily by reducing the role of the Infanta. He also accepted a substitute ending for Act II in a third handwriting, for early in Act III he replaced a short passage with a new version consistent with the substitute ending of Act II. None of these changes indicates a return to the text of the original autograph, and all diminish the manuscript's value in establishing the text. Rojas' most valuable contribution to the text's improvement was supplying readings for numerous verses omitted in part or entirely by the copyist. In fewer verses he emended the copyist's version; but the fact that obvious errors went uncorrected indicates that his emendations were somewhat haphazard. In some cases the additions and emendations are probably incorrect.

The present edition is based on the manuscript despite its deficiencies, but passages excised or altered for clearly non-literary reasons are included in the Text in brackets on the basis of the best readings in previous editions. Only the most obvious errors of the manuscript have been corrected. Doubtful readings are indicated in the Notes, and corrections are sometimes suggested. No verse included only in the manuscript has been omitted, although doubt is expressed in the Notes that certain verses appeared in Rojas' original autograph. This edition is not to be considered definitive in view of the deficiencies of all known extant texts of the play.

This comedia palaciega, written rather early in the author's career, is not one of Rojas' best plays. It has been rarely performed or commented upon by critics of his theater. Its emphasis on the intrigue and effects of balance and contrast is not matched by originality in expression or care in the handling of plot details, especially in Act III. In its strophe-forms the play, though somewhat unusual in the length of certain passages of romance and silva, is in general typical of Rojas' practices in the plays of his Partes. Much of the play's interest lies in its relations to the dramatist's other works. In addition to major resemblances discussed in the Introduction, many

similarities of detail, including the verbatim or almost verbatim repetition of its verses in other plays, are indicated in the Notes. The latter also include comment on many aspects of the play's style and language with reference to similar examples in other works by Rojas and his contemporaries. 630 pages. $8.00. Mic 58-4336

LITERARY ACADEMIES AND PROSE FICTION IN SEVENTEENTH-CENTURY SPAIN

(Publication No. 23,444)

Willard Fahrenkamp King, Ph.D.
Brown University, 1957

One of the major factors in the cultural environment of the Spanish seventeenth century is the private literary academy, which began its development in the first half of the sixteenth century and reached perhaps the summit of its popularity in the 1620's and 1630's, when the Academia de Madrid counted among its members almost all the famous writers (including Lope, Góngora, Quevedo, and Calderón) resident in the capital. These literary clubs usually met once a week, adopted constitutions, elected officers, enjoyed the patronage of wealthy nobles, and produced much light verse and many prose discourses on moral philosophy, government, or literary criticism. Occasionally also they performed plays or displayed their ready wit in extemporized verses. Their favorite diversion, however, was the elaborately organized certamen poético in which poets competed for various prizes offered for the best composition on a given subject.

Numerous and popular as the academies were, it is not surprising that even works of prose fiction--with which academies seldom dealt--frequently reflect the academic activities and enthusiasms of their authors, sometimes only through brief allusions, sometimes in protracted passages given over to academic verses or discourses or even the recording of a complete academy session. Of the slightly over two hundred works of prose fiction published in the seventeenth century sixty-six, or roughly one third, contain some reference to academies.

Furthermore, no type of prose fiction is immune to the invasion of academic material. The pastoral novel, always a loose compound of verse and subtly refined dialogue, early proved hospitable to academic interpolations, while the outer structure of the framed-tale collection--the cultivated group of ladies and gentlemen met to narrate stories--could with great ease be converted into a real academy. In several cases the academic element within these two novelistic types looms so large that it seems justifiable to term certain works, such as Gaspar Mercader's pastoral Prado de Valencia or Polo de Medina's Academias del jardín, true "academy novels."

Less apt to be saturated by this type of digression than the pastoral or the framed tale, the satirico-picaresque novel nevertheless makes wide use of academy sessions, sometimes to proclaim the author's own literary theories and ridicule the practices of his literary enemies. The novela cortesana, once devoted exclusively to the rapid narration of tales of love and adventure, likewise shows a tendency as the century wears on to utilize academic episodes, often designed to demonstrate the hero's intellectual agility. In the end only the heroic novel modeled on Heliodorus remained almost entirely free of academic interpolations.

The reasons for the inclusion of so much "literary" material in prose fiction are not difficult to determine. An author interested in portraying the life of well-bred people could scarcely fail to mention the ubiquitous academy. Or he might only wish to gain the approval of his literary colleagues by including within his novel some reference to the academies they all attended. Not infrequently, also, the academic material is nothing more than padding for an ill-constructed story. More important, however, is the fact that in prose fiction--which possesses no classical model (with the minor exception of the late-classical Byzantine novel) or theoretician--the author was an innovator not only free, but forced, to make experiments. In such works as Montalbán's Para todos the erudite or poetic academic episode is intended to dignify a literary form whose inherent worth and uniqueness had not been fully recognized.

In only a few novels does the academic material not constitute a disruptive element. But prose fiction is an anomalous form whose precise definition still troubles us; and it is natural that seventeenth-century authors should have held divergent views about its legitimate qualities or that some should have tried to inject into it material which proved irreconcilably alien.

229 pages. $3.00. Mic 58-4337

BOTH CENTERS ONE: THE REASON-FAITH EQUATION IN DONNE'S SERMONS

(Publication No. 25,378)

Irving Lowe, Ph.D.
Stanford University, 1957

The problem of the relation of reason to faith in Donne's thought has especially interested twentieth-century scholars. In an effort to define Donne's theological position, critics like Louis I. Bredvold, Theodore Spencer and C. M. Coffin have first cited Thomist teaching to the effect that "one true God and Lord can be known with certainty by the natural light of human reason," and have then attempted to show that Donne taught the inadequacy of reason for supernatural truth. Thomism, they argued, equated faith and reason, but Donne set faith above reason. Under the impact of the "new philosophy" which called all things in doubt, Donne in despair sought the security of a personal faith which transcended and even contradicted all reason.

The present research advances the thesis that Donne's thought on the problem of reason and faith is well-nigh indistinguishable from that of St. Thomas. It urges that the Thomist position has not been rightly understood by the critics, and that therefore, to the extent that this position, so misinterpreted, has served as a standard by which to evaluate Donne's position, Donne has been misunderstood. Like St. Thomas, Donne equates faith and reason. When he places faith "above" reason it is only in this sense, that for Donne as for St. Thomas faith proposes to reason certain transcendent motives to which reason may, rather must, give its complete assent; for faith does not contradict reason, but rather fulfills it.

If then Donne is seen to be thoroughly Thomist in his theology, it is no longer possible to propose that the "new philosophy" engendered for Donne a cleavage "between the realms of the physical and metaphysical." A careful reading of Donne's writings will show that Donne early and late was in possession of a religion deeply reasoned, traditional and impersonal. This religion he never repudiated, though for a time he may have seemed to ignore it. It taught him the value of reason as faith's bulwark; it also taught him to distrust the reason when reason undertook to define matters outside its proper sphere; and finally it taught him to regard scientific "fact" as (in the words of M. Maritain) "neither enlightening nor fertile except in the context of an ontological analysis of reality."

Such an ontology Donne's writings, and certainly the sermons, amply yield. So clearly does the pattern of Donne's theology stand out in the sermons that it becomes apparent that not many critics have read the sermons carefully in this matter of reason and faith. Otherwise the common view as to Donne's fideism would be quite unaccountable. What seems to have happened is that scholars have built their critical constructions from the gleanings of the poems (often misinterpreted), mining the sermons only for isolated passages to illustrate predetermined points of view. Hence it is that to critics of the twenties and thirties Donne appeared to be a congenial precedent for the modern confusion, the modern scepticism. However, a more informed criticism has in recent years been recovering the Donne whose roots were deep in scholastic ontology and for whom, oddly enough, the via media which the Anglican churchman espoused turns out to be the very way of St. Thomas. 180 pages. $2.35. Mic 58-4338

PROBLEMS OF CHARACTERIZATION IN THE NOVELS OF ELLEN GLASGOW

(Publication No. 25,255)

Frank Berry Moake, Ph.D.
University of Illinois, 1957

Chapter I examines the social backgrounds of Miss Glasgow's leading characters and develops the contention that the classes best represented are the Tidewater "aristocracy" and the Scotch-Irish yeomanry. Although the protagonists in a number of novels are poor whites, they cannot be considered representative of their class. Negro characters, seldom fully developed, are never of primary importance; therefore, they serve chiefly to fill out background.

Chapters II and III, which are very closely related, assess Miss Glasgow's over-all skill in the handling of character. Chapter II deals with subordinate characters, Chapter III with major characters; each chapter treats both the conception and the technique of presentation of character. Although Miss Glasgow was not uniformly successful in the creation of believable characters, her work contains many characters, both major and subordinate, who are interesting, memorable, and credible. In general, she experienced her greatest success in the delineation of defiant young women and of men who have been defeated or by-passed by life. Her studies of vigorous, successful young men are never wholly satisfactory. A chronological survey of her work does not reveal steady improvement in her ability to conceive and project vivid, interesting characters; it does reveal steady growth in her mastery of technique--in her ability to individualize characters and to reveal them indirectly. Perhaps her greatest strength as a novelist is her successful delineation of a wide range of character types.

Chapter IV takes up the problem of focus. The basic question here is this: To what extent does the author focus the reader's attention on the appropriate characters and keep it there? This question is especially important in relation to Miss Glasgow's work, for the effect of many of her novels is weakened by poor focus. Of her last ten novels, at least three are seriously lacking in focus, but the problem is most serious in They Stooped to Folly, in which a minor character grew beyond her intended proportions and worked serious mischief. Some other later novels move on two levels--action and interpretation--and have been misread by critics who attached too much significance to characters important chiefly to the action when interest should center in characters important to interpretation.

An examination of point of view in Chapter V reveals that Miss Glasgow used point of view less as a narrative device than as a means of characterizing. She felt a need to comment on the characters and the action; an internal point of view permitted her to comment without appearing to do so. After some early experiments with other methods, she came to rely on a method of limited omniscience. Still later, she centered point of view in two characters, whose interpretations are generally contrasted. This variable point of view represents a compromise between the extreme looseness of complete omniscience and the extreme tightness of James's "dramatized mind." Although the compromise enabled her to explore more completely a complex social milieu, it complicated the problem of focus, especially in They Stooped to Folly.

Chapter VI outlines recurrent character types and describes their symbolic and structural functions. Miss Glasgow learned to compensate for an early tendency of her plots to subvert theme by relying on antithesis of character rather than plot as a basic structural device. The later novels replace a carefully articulated plot with a series of situations to which the figures respond in characteristic and revelatory ways. Thus, theme is developed through character contrasts rather than through action. 255 pages. $3.30. Mic 58-4339

THE POEMS OF JOHN SHEFFIELD, EARL OF MULGRAVE, MARQUIS OF NORMANBY, AND DUKE OF BUCKINGHAM (1648-1721): A CRITICAL TEXT

(Publication No. 25,267)

Richard John Purdum, Ph.D.
University of Illinois, 1957

The poetry of John Sheffield, one of the major Restoration Wits, has never been presented in any complete or authoritative edition, and the present study is intended to fill that gap in English literature of the neoclassical period.

Although the primary concern of the study has been to establish the texts of Sheffield's poems, a full critical Introduction has also been included, in which the attempt is made to determine the relation of Sheffield's poetry to other contemporary writing and to assess it as literature.

The Introduction reviews Sheffield's contemporary reputation and discusses his relations with Dryden and Pope. It then classifies Sheffield's poems into four categories--translations and imitations, literary criticism, occasional poems, and love songs and poems--and presents a critical review of the poems, examining such matters as Sheffield's techniques of translation, with emphasis on his translation of Ovid's "Helen to Paris" and "Part of Virgil's IV. Georgick" as they compare with Dryden's translations of Ovid and Virgil and on Sheffield's "The Picture" as it compares with the Anacreontiques of Cowley and other contemporaries; the background and literary quality of "An Essay on Satyr"; Sheffield's life-long revisions of "An Essay on Poetry," a poem so constantly improved upon that, as Dr. Johnson said, "there is scarcely any poem to be found of which the last edition differs more from the first"; the circumstances and quality of his occasional poems; and the literary merits of his love poems. Finally, the Introduction presents a summary and discussion of the nature of Pope's work as editor of Sheffield's Works (1723).

Establishing the texts of Sheffield's poems must be the major emphasis of an initial study because, apparently, it has never been realized how drastically Pope revised many of the poems and how uncertain in several cases Sheffield's final intentions actually are. Although with most poems the textual problem is relatively uncomplicated, it is nevertheless often necessary to call attention to pre-Pope versions; and with several poems Sheffield's own version has evidently never been generally known. "An Essay on Satyr," for example, exists in widely varying texts and manuscripts, no one of which can be shown to be directly connected with Sheffield himself, and "An Essay on Poetry" was apparently revised by Sheffield between the last publication of the poem during his lifetime and the posthumous, drastically revised text in Pope's edition, so that Sheffield's own final intention with both poems can be established only by textual discovery and reconstruction. "The chusing a Poet Laureat on the death of Mr. Row" exists in a previously unpublished and largely unknown manuscript which it seems necessary to accept as Sheffield's version rather than the more widely disseminated text of Pope's edition. An important aspect of the textual study is the light cast by establishing Sheffield's texts on the "editorial" methods of Pope.

Finally, as a working basis for what is intended ultimately to be a full-scale critical edition of the poems, the study includes a bibliography of all primary sources in which poems by Sheffield have been discovered and a list of the secondary sources most important in the evaluation and annotation of the texts.

492 pages. $6.25. Mic 58-4340

MORAL FREEDOM AS THE KEY TO DOSTOYEVSKY'S MAJOR NOVELS

(Publication No. 25,135)

Joseph Aloysius Rogers, Ph.D.
St. Louis University, 1957

In the paean with which the English-speaking world has received the Garnett translation of Crime and Punishment, The Idiot, The Possessed, and The Brothers Karamazov, one discord has persistently sounded. A considerable body of Anglo-American criticism, of which Joseph Conrad and Henry James are representative, holds that Dostoyevsky's novels are structurally defective, that the Russian titan, despite his genius, never mastered the problem of form.

Such critics interpreted Dostoyevsky in a positivistic and therefore in an inadequate frame of reference. The inadequacy of this framework becomes especially clear in the matter of human freedom. In the dichotomy that split nineteenth-century men into naturalists and supernaturalists, "freedom" acquired two disparate meanings. To the naturalist freedom was primarily a civic term, denoting an absence of political and economic coercion; for him the utopian socialism of Saint-Simon offered the most promising path to the fullest freedom. To a supernaturalist such as Dostoyevsky, freedom was primarily an ethical and moral concept, extending far beyond Saint-Simon's sense of civic and economic latitude.

The Russian writer made his four major novels--Crime and Punishment, The Idiot, The Possessed, and The Brothers Karamazov--the testing ground for two various concepts of freedom. The conflict in these novels, at their deepest levels, is a conflict between two versions of Freedom: Saint-Simon's and Saint Paul's. The characters of these works embody various aspects of the problem of freedom.

Appalled by the evil and suffering that he finds in the world, Ivan Karamazov envisages a "vast, unanimous antheap" in which the burden of freedom and responsibility will be lifted from the shoulders of most men. Shigalov is perplexed by the fact that starting from "unlimited freedom" he arrives at "unlimited despotism," but he is eager to force his new moral order on mankind.

Opposed to the Ivans, the Shigalovs, and their variants are such figures as Alyosha Karamazov and Prince Myshkin, who believe that man realizes his greatest potentiality by accepting the awesome gift of free will and, in heart and mind and body, bringing his will in conformity with God's will.

Dostoyevsky's preoccupation with the problem of freedom manifested itself not only in the characters he chose and in the sequence of events through which they move, but in his method of treating those characters. Unlike his contemporaries such as Zola and Balzac, who stressed social environment in their novels, Dostoyevsky focused his attention on the will, in which, Christianity teaches, the most dramatic expression of freedom takes place.

Freedom, therefore, in its full, rich, complex, Christian sense is a salient element in Dostoyevsky's major novels. Any interpretation or evaluation orientated to mere positivistic values is simplistic and unjust. When moral freedom is accorded its proper emphasis, the integrity of Dostoyevsky's art becomes clearer and a more just appraisal of the form of his major novels becomes possible.

190 pages. $2.50. Mic 58-4341

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

THE EARLY CAREER OF W. B. YEATS

(Publication No. 25,179)

Hildegard Schmalenbeck, Ph.D.
The University of Texas, 1957

Supervising Professor: Harry Huntt Ransom

William Butler Yeats, whose career began in the Victorian period and ended on the eve of World War II, spoke for a succession of literary generations. This fact has been acknowledged by his early and his later critics, who thus establish the universality of his appeal. Yeats' position in literature today is based almost entirely on his poems, among which his later ones are usually isolated to illustrate his gifts. The occultism which at times served as the basis of his symbolism is frequently singled out as the most important clue to an understanding of his talents and in itself becomes symbolic of Yeats' attitudes. The result is an image of a poet whose legacy of half a century's endeavors is a volume of verse and whose primary predilection was with magic and with visions. Some of his critics construe this predilection as a symbol of fundamentally escapist tendencies; others see it as a uniquely effective means of grasping ultimate realities. The criticism based on these viewpoints then often becomes almost acrimonious; and Yeats, caught in the crossfire, is, in effect, a victim of his apologists; for it is almost forgotten that he was a man of practical accomplishments and that he was a versatile man of letters. Yet emphasis of these facts would help explain his poetry, his chief claim to fame: for the poems were written by one who was versatile and practical as well as visionary.

To establish the conception of Yeats which prevails and to examine the criticism which in large part has determined this conception is the function of the first portion of Part I of this study; the remainder of this section then consists of some suggestions for studies which could be made and which, if they were made, would serve to reconstitute an image of the poet Yeats so as to make clearer the bases of his status as a major writer. These suggestions presuppose acceptance of the premises that Yeats deserves recognition for all he attempted; that knowledge of the totality of Yeats' career will throw light on the interrelationships of each phase of that career; and that realization of how he surmounted practical difficulties will increase his stature as a man of letters.

Part II of this study is a presentation of selected facts which would facilitate studies such as those indicated in Part I: it is an annotated catalogue of Yeats' literary activities through 1893. Although such a calendar would be more valuable if it covered the entire career, even a sampling serves to illustrate the potentialities of such a factual approach. Yeats' earliest period was chosen, both because it is often neglected and also because during this apprentice period, in which he experimented with various genres, Yeats formed literary habits which remained part of his practice and he explored subjects which influenced the direction of his later work. Through this calendar, Yeats' versatility emerges in clear focus: he is shown to have succeeded as editor, critic, journalist, scholar, folklorist, short story writer, and dramatist, as well as poet. It is suggested that these various literary endeavors merit evaluation not only as examples of Yeats' manifold talents or for their possible intrinsic merits but also as influences on his poetic effects: for through the patent correspondence of his contemporary interests, one realizes that Yeats' poetry was an outgrowth of his other literary labors.

423 pages. $5.40. Mic 58-4342

CRITICISM OF FORMAL SATIRE IN THE RENAISSANCE

(Publication No. 23,874)

A. L. Soens Jr., Ph.D.
Princeton University, 1957

Renaissance criticism of Satire lay well within the limits of traditional criticism of Satire, and incorporated materials drawn ultimately from the three traditional repositories of criticisms of Satire: the summary discussions of the classical and post-classical grammarians and historians, who commented upon Satire and discussed the history of the drama, classical and post-classical scholarly annotations to classical Satires, and the Satires themselves. The material from each of these repositories was transmitted to Renaissance criticism of Satire through its own channels; material from each contributed characteristic emphases and implications to Renaissance criticism, and material from each had a relatively strong influence upon one sort or another of Renaissance criticism.

The comments of classical grammarians and historians came to the Renaissance through both manuscripts of the works themselves, and through medieval compendia. They are reflected in the Renaissance scholars' prefaces, and they passed to the critics, and the prefaces of Renaissance satirists. Classical, post-classical, and medieval scholars' annotations to the Satires of Horace, Persius, and Juvenal are reflected in the annotations of Renaissance scholars, and in Renaissance satirists' Satires. Renaissance satirists imitated classical Satire, and thus the influence of Horace, Juvenal, and Persius on the practice of the satirists was great, and direct.

Classical and post-classical grammarians and historians commented upon the putative history of the drama, emphasized the supposed dramatic extraction of Satire, and consequently suggested that the style and manner were, or should be, similar to the style and manner of the satyr, or the satyr-play. The classical and post-classical scholars discussed the putative influence of the satyr-play in their prefaces, but emphasized the influence of Old Comedy, and the Cynic and Stoic versions of the Socratic dialogue, in their annotations. The Satires of Horace, Persius, and Juvenal offered Renaissance satirists and critics of Satire examples of the dialogue form, and suggested, indirectly, the influence of Old Comedy and the dialogue.

The classical grammarians and historians, and their later imitators, had their greatest influence on the authors of Renaissance handbooks of criticism. They suggested, by their emphasis on the satyr-play and Varronian satire, that Satire should be punitive, obscene, and written in a style obscure and strange. As their comments were refracted through the Middle Ages and its compendia, the grammarians and historians seemed also to suggest that a Satire might resemble an encyclopedia. The Medieval comment also suggested that Satire should be written in a style rhetorically appropriate to denunciation.

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Classical and post-classical scholars had their greatest influence upon Renaissance scholars, and through them, upon Renaissance satirists. Thus Renaissance scholars, following their predecessors, discussed the philosophy which Horace discussed and Persius urged. In these scholarly discussions, the annotators mentioned the obscurity which must necessarily, they believed, accompany a discussion of philosophy; the dialogue form, appropriate to informal philosophical discussions; and the purpose of such discussions, intended not to punish, but to enlighten. The annotators also suggested a style, drawn equally from Old Comedy and Horace, a style clear, yet elegant, without ornamentation and without turgidity; a style simple and urbane, which could fit the satyr-play, the Old Comedy, or the Satires of Horace.

The satirists in the Renaissance imitated classical Satire, and read the scholars' annotations. Thus they discussed philosophy, and tried to write in a "plain" style, even though, in England, they could not always repress a fondness for punishment and elevated obscurity. The scholars in the Renaissance approached that accuracy in their statements about Satire which the satirists often achieved in their imitations. With the exception of Sidney, the authors of critical handbooks wandered lost in the mazes laid out by the post-classical grammarians and historians. 493 pages. $6.30. Mic 58-4343

THE DRAMATIC PRINCIPLES OF GEORGE BERNARD SHAW

(Publication No. 25,392)

Terence James Spencer, Ph.D.
Stanford University, 1957

The Shavian dramatic revolution was the culmination of a century of effort by literary men to reform the drama. Shaw's first dramatic principle is that the literary aspect of drama takes precedence over the theatrical. Furthermore, the playwright's work should express his own subjective vision of reality and should conform neither to prevailing mechanical requirements of form nor to popular moral ideas. The dramatist legislates moral philosophy in a form appropriate to his inspiration.

By writing plays based on these principles Shaw instituted the dramatic wing of the Romantic Movement. Four difficulties had obstructed Romantic drama: (1) a divorce between literature and the stage; (2) the influence which stage traditions nevertheless had on dramatic literature; (3) the apparent irreconcilability of the subjective Romantic spirit and the traditionally objective dramatic form; (4) the absence of a Romantic theory of drama. Shaw overcame the first by insisting on the playwright's authority at a time when men of the theater themselves aspired to literary merit; the second by attacking dramatic conventions, especially the well-made play; the third by writing successful plays founded on his own subjective vision; the fourth by developing a theoretical justification of his practice.

English Elizabethanism retarded the development of a Romantic drama--a drama, that is, which permits subjective expression in a form altogether new and yet dramatic --by encouraging the imitation of older forms in which subjectivity could be expressed in lyric passages. An alternative tradition, German Romantic philosophical drama, was generally misunderstood, suppressed, or ignored. The dramatic form typified by Faust is reflected in Byron's plays, Shelley's Prometheus Unbound, and some of Browning's work. Faust itself influenced Shaw through operatic adaptations. Except for his devotion to Shelley, Shaw was not influenced by the native philosophical-drama tradition so much as he was by continental writers. His recognition of Peer Gynt as a successor to Faust led Shaw to admire Ibsen's sociological dramas.

Shaw's theoretical justification for Romantic philosophical drama is based on principles in Shelley's "Defence of Poetry," such as that the drama is an instrument of social reform, that the playwright is inspired both in form and doctrine. Shaw further emphasizes the predominance of the playwright by regarding drama as analogous to music. This analogy influenced the structural organization and diction of his plays and his theory of acting. Shaw's concept of the actor as "dramatic instrument" underlies his differences with William Archer. Shaw's notion of comedy differs from that of George Meredith in maintaining that comedy overthrows established moral customs, thereby justifying the comic playwright according to his general Shelleyan theory of poetry.

The end of poetry, for Shaw and Shelley, is man's moral improvement. Shaw's "unpleasant" plays seek this end by irritating the audience into questioning its moral notions. The "pleasant" plays are closer to Shelley's doctrine in that they deal less with specific temporal problems and more with human nature. The Man of Destiny and the "Plays for Puritans" present heroes as moral examples, a practice again closer to Shelley's recommendations; and each hero exhibits qualities Shelley found in Milton's Satan. In Man and Superman Shaw first used myth as dramatic material, thereby meeting Shelley's doctrine that a poem should be susceptible to infinite varities of interpretation. Shaw's plays from then on are modern reinterpretations of old myths or modern stories that function as myths, such as Major Barbara.

In producing and criticizing Shaw's plays, one must recognize into which of these classes any one falls. Shaw criticism must begin by recognizing that his drama is a genuinely original form, which cannot be discussed in Aristotelian or traditional terms.

178 pages. $2.35. Mic 58-4344

VALIDATION OF THE UNIVERSITY OF ILLINOIS LIBRARY SCHOOL PLACEMENT EXAMINATION

(Publication No. 25,213)

James Parvin Dyke, Ph.D.
University of Illinois, 1957

Coincident with the post-World War II restructuring of education for librarianship, the University of Illinois Library School began to utilize examinations for placing entrants at various levels of the new structure. Results from these examinations were used as the basis for making individual judgments concerning the level of development and for suggesting programs of study for entrants.

This study has as its objective the investigation of the validity of the third edition of the Placement Examination. It provides evidence concerning the individual judgments of the Library School faculty and demonstrates the extent to which the policies concerning placement, as well as practical judgments resulting from these policies, are justified. Background for the Placement Examination is presented by a summary of the historical position of library education; a survey of the use of tests and measurements in library education; an account of the suggestions for examination within the new structure of library education; and a report of the activities of the Illinois Library School faculty with respect to such examinations.

The most recent concepts of validity are presented. From the kinds of judgments desired of the Placement Examination the appropriate types of validity were determined to be content, concurrent and construct. For each of the sections of the Placement Examination a statement of objectives for the course to which the section applied was developed. These objectives were in matrix form rather than in prose form. The matrices were a logical analysis of course content and behavioral operations with respect to the content. The examinations were constructed as purposive samples of the matrices. The method of construction provided evidence concerning content validity, and was reinforced by statistical procedure which provided coefficients of internal consistency. Concurrent validity was studied by consideration of the ability of the examinations to discriminate between concurrent criterion status groups known to be widely spaced on a scale of ability. Construct validity was examined through the development of several explanatory constructs. Comparison of entrants was made between performance before and after having taken the applicable courses. Further comparison was made of post-course and library degree holding groups. An additional construct considered the relationship between relative success with the total year of graduate study and whether or not entrants were excused from or took a course because of the screening provided by the Placement Examination.

Each of the sections was held to possess content validity by virtue of the manner in which it was constructed and the support provided by coefficients of internal consistency. Each section exhibited evidence of concurrent validity through inferences drawn from significant differences between the means of the concurrent criterion status groups. The procedures for construct validity provided statistical inferences that entrants tended to merge into a single group, after having been divided by the examinations, and after non-exemptees had taken the pregraduate professional core courses.

The establishment of the validity of the third edition of the Placement Examination has several practical implications. The established appropriate validities for the sections substantiate their use as screening instruments, and justify Library School policies concerning exemption from core courses, as well as justifying the individual judgments resulting from the policies, making these judgments defensible, equitable and objective. They verify the proposals of the Association of American Library Schools that examinations could be used to aid articulation between undergraduate and graduate library education. Also, the validation of these examinations forms the groundwork for definitive establishment of the "core" by library schools, combined placement activities by several or all library schools, and possible development of a national certification examination for the library profession.

177 pages. $2.35. Mic 58-4345

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ON BABYLONIAN PLANETARY THEORIES

(Publication No. 23,418)

Asger Hartvig Aaboe, Ph.D.
Brown University, 1957

The goal of these investigations is, firstly, to understand which elements of the planetary motion are reflected in the different numerical schemes devised by the Babylonian astronomers for the determination of date and longitude of the characteristic synodic phenomena of the planets, i.e. their first and last appearance, stationary points, and opposition. Secondly, the aim is to test the accuracy of the Babylonian schemes.

To this end simple geometrical models for the planets' apparent motion around the earth, based on circular motion, are constructed. The models are accurate enough for the present purpose, and have obvious advantages from a computational point of view. Incidentally, this construction provides a syntheses of Ptolemy's planetary models.

The Babylonian planetary theories are outlined, as far as they are known, and a new justification of the period relations given.

The planets are then treated one by one.

It is found that for the outer planets the mean distance and the eccentricity are the deciding factors for the characteristic phenomena, while for the inner planets the latitude assumes great importance.

It is further found that for the outer planets the phenomena, save first and last appearance of Mars, are very well approximated, while for Mercury one can expect some divergencies despite the fact that the characters of the functions involved are exceedingly well reproduced by the Babylonian schemes. For Venus the textual situation is so poor that no decisive conclusions can be drawn.

133 pages. $2.00. Mic 58-4346

CONVERGENCE OF THE WICK-CHANDRASEKHAR APPROXIMATION TECHNIQUE IN RADIATIVE TRANSFER

(Publication No. 24,623)

Philip Marshall Anselone, Ph.D.
Oregon State College, 1957

Major Professor: Dr. Arvid T. Lonseth

The distribution of radiation intensity in an attenuating atmosphere is governed by the integrodifferential equation of transfer. This thesis concerns the classical transfer problem, which pertains to isotropic scattering in a plane parallel atmosphere of infinite optical depth. The intensity, $I(\tau,\mu)$, is defined for $\tau \geq 0$ and $-1 \leq \mu \leq 1$, is non-negative and not identically zero, and satisfies the conditions,

$$\mu \frac{\partial I(\tau,\mu)}{\partial \tau} = I(\tau,\mu) - J(\tau), \tag{1}$$

$$J(\tau) = \frac{1}{2} \int_{-1}^{1} I(\tau,\mu)\, d\mu, \tag{2}$$

$$I(0,\mu) = 0, \qquad -1 \leq \mu < 0, \tag{3}$$

$$\lim_{\tau \to \infty} e^{-\tau/\mu} I(\tau,\mu) = 0, \qquad 0 < \mu \leq 1, \tag{4}$$

$$F = 2 \int_{-1}^{1} I(\tau,\mu)\, \mu\, d\mu, \tag{5}$$

where F is an arbitrary preassigned positive constant.

Since this problem has a unique solution (first obtained by Hopf), it is used to test methods for attacking other transfer problems. The Wick-Chandrasekhar approximation technique involves replacing, for each n = 1, the integrals in (2) and (5) by the sums corresponding to the 2n point Gauss quadrature formula. The resulting problem, which is essentially a set of simultaneous ordinary differential equations, yields approximations, $I_n(\tau,\mu)$ and $J_n(\tau)$, to $I(\tau,\mu)$ and $J(\tau)$. The same technique has been used with other quadrature formulas, notably the "double-Gauss" formula of Sykes, in which the n point Gauss formula is applied separately in each of the intervals $-1 \leq \mu \leq 0$ and $0 \leq \mu \leq 1$. This thesis contains a generalization of the Wick-Chandrasekhar technique which includes all published variations.

From (1)-(4) one obtains

$$I(\tau,0) = J(\tau), \tag{6}$$

$$I(\tau,\mu) = \int_0^{\tau} e^{(\tau-t)/\mu} J(t) \frac{dt}{-\mu}, \qquad -1 \leq \mu < 0, \tag{7}$$

$$I(\tau,\mu) = \int_{\tau}^{\infty} e^{(\tau-t)/\mu} J(t) \frac{dt}{\mu}, \qquad 0 < \mu \leq 1, \tag{8}$$

$$J(\tau) \geq 0, \qquad J(\tau) \not\equiv 0. \tag{9}$$

The substitution of (7) and (8) into (2) and (5) yields

$$J(\tau) = \int_0^{\infty} K_1(\tau-t)\, J(t)\, dt, \tag{10}$$

$$F = -4 \int_0^{\tau} K_2(\tau-t)\, J(t)\, dt + 4 \int_{\tau}^{\infty} K_2(\tau-t)\, J(t)\, dt, \tag{11}$$

where

$$K_r(x) = \frac{1}{2} \int_0^1 e^{-|x|/\mu}\, \mu^{r-2}\, d\mu, \qquad r \geq 1. \tag{12}$$

The substitution of $J(t) = t + q(t)$ into (10) yields

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$$q(\tau) - \int_0^\infty K_1(\tau-t)\, q(t)\, dt = K_3(\tau). \qquad (13)$$

Hopf solved equation (13) by iteration. His solution is actually the sum of the Neumann series determined by the integral operator in (13). Hopf also proved that the unique solution to the problem defined by (9), (10) and (11) is

$$J(\tau) = \frac{3}{4}\,[\,\tau + q(\tau)\,]. \qquad (14)$$

The intensity, $I(\tau,\mu)$, is given in terms of $J(\tau)$ by (6)-(8).

The procedure outlined above is employed in the thesis to re-formulate the problem for the functions $I_n(\tau,\mu)$ and $J_n(\tau)$. We obtain equations (6)-(14) with a subscript n added to each of the functions involved and the integral in (12) replaced by a numerical integration sum. A generalization of the problems for $J(\tau)$ and $J_n(\tau)$ is defined and solved by the Neumann series method. Results concerning uniformity of convergence are new even for the special case considered by Hopf.

It is proved in the thesis that, if the Gauss or the double-Gauss quadrature formula is used, the general term of the series for $J_n(\tau)$ converges to the general term of the series for $J(\tau)$, and that the series for the $J_n(\tau)$ are equiconvergent. Thus, the interchange of limits is justified and $J_n(\tau) \to J(\tau)$. It then follows by (6)-(8) that $I_n(\tau,\mu) \to I(\tau,\mu)$. Convergence is uniform for $-1 \leq \mu \leq 1$ and $0 \leq \tau \leq t$, for each $t > 0$.

64 pages. $2.00. Mic 58-4347

AN APPROXIMATION METHOD FOR PLANE GAS FLOWS

(Publication No. 23,424)

David Alan Beckwith, Ph.D.
Brown University, 1957

The ensemble of fictitious gases is deduced, for which the hodograph flow equations can be integrated by the method of Laplace-Darboux. The gas laws contain 1, 2, 3, ..., free parameters, which may be disposed so as to approximate the law of a real gas over a supersonic or a subsonic domain. For the approximate hodograph equations Riemann's function and the mapping of solutions back into the plane of the physical coordinates are treated.

44 pages. $2.00. Mic 58-4348

CONTINUED FRACTIONS WITH ABSOLUTELY CONVERGENT EVEN OR ODD PART

(Publication No. 25,163)

David Fleming Dawson, Ph.D.
The University of Texas, 1957

Supervisor: Professor H. S. Wall

Let f(a) denote the continued fraction

$$\frac{1}{1} + \frac{a_1}{1} + \frac{a_2}{1} + \frac{a_3}{1} + \cdots$$

and g(b) denote the continued fraction

$$\frac{1}{b_1} + \frac{1}{b_2} + \frac{1}{b_3} + \cdots,$$

where each of a and b is a complex number sequence. Theorem. If the odd and even parts of g(b) converge, the odd (even) part absolutely, then g(b) converges if the series $\Sigma|b_{2p-1}|$ (the series $\Sigma|b_{2p}|$) diverges. An example is given which shows that the condition that the series $\Sigma|b_{2p-1}|$ diverge cannot be replaced by the condition that the series $\Sigma|b_p|$ diverge. Theorem. If there exist a number sequence $\{r_{2p}\}_{p=0}^{\infty}$ and a number M such that

1) $0 < r_{2p} \leqq 1$, $p = 0, 1, 2, 3, \cdots$,

2) $0 < M \leqq \prod_{i=1}^{n} r_{2i-2}$, $n = 1, 2, 3, \cdots$, and

3) $r_{2p}\,|\,1 + a_{2p-1} + a_{2p}\,| \geqq r_{2p} r_{2p-2}\,|\,a_{2p-1}\,| + |a_{2p}|$, $p = 1, 2, 3, \cdots$,

then f(a) converges if some $a_{2q} = 0$ and $a_{2p-1} \neq 0$, $p = 1, 2, 3, \cdots$, or in case no term of a is zero and the series $\Sigma|b_{2p-1}|$ diverges. An example is given which shows that if some $a_{2q} = 0$, then the condition that $a_{2p-1} \neq 0$, $p = 1, 2, 3, \cdots$, cannot be removed. Also an example is given which shows that the condition on the r_{2p} that there exist a number M such that

$$0 < M \leqq \prod_{i=1}^{n} r_{2i-2}, \quad n = 1, 2, 3, \cdots,$$

cannot be removed. Theorem. If there exist a number sequence $\{r_{2p}\}_{p=0}^{\infty}$ and a number r such that

1) $0 < r_{2p} \leqq r < 1$, $p = 0, 1, 2, \cdots$, and

2) $r_{2p}\,|\,1 + a_{2p-1} + a_{2p}\,| \geqq r_{2p} r_{2p-2}\,|\,a_{2p-1}\,| + |a_{2p}|$, $p = 1, 2, 3, \cdots$,

then f(a) converges absolutely if one of the sequences $\{a_{2p-1}\}_{p=1}^{\infty}$ and $\{a_{2p}\}_{p=1}^{\infty}$ contains no zero term. An example is given of a number sequence $\{r_{2p}\}_{p=0}^{\infty}$ and an unbounded sequence a which satisfy the hypothesis of this theorem. Also, an example is given which shows that the condition that one of the sequences $\{a_{2p-1}\}_{p=1}^{\infty}$ and $\{a_{2p}\}_{p=1}^{\infty}$ contain no zero term cannot be removed.

31 pages. $2.00. Mic 58-4349

ON LEBESGUE AREA

(Publication No. 23,431)

Maurice Rolland Demers, Ph.D.
Brown University, 1957

The principal results obtained in this paper are two supplementary conditions, each of which is sufficient for the validity of the inequality

$$(*) \qquad L_k(f) \leq \Sigma\,[L_k(P_n^{\xi} \circ f):\ \xi \in \Omega_n^{k}]$$

where f is a continuous map of a k dimensional finitely triangulable space X into Euclidean n-space E_n, with

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$n \geq k$, L_k is the k dimensional Lebesgue area, Ω_n^k is the set of all k termed sequences ξ of integers such that $1 \leq \xi_1 < \xi_2 < \ldots < \xi_k \leq n$, and P_n^ξ is a principal projection of E_n onto E_k defined by $P_n^\xi(x) = (x \circ \xi)$ for $x \in E_n$.

Using the norm of a cohomology class introduced here to define the multiplicity M(g, y) with which a continuous map g of X into Euclidean k-space assumes the value y, it is shown that a sufficient condition for the validity of (*) is that the k+1 dimensional Hausdorff measure of f(X) be 0. It is also proved that if n = k, then the Lebesgue area of f equals $\int M(f, y)dy$, an integral with respect to Lebesgue measure over k-space.

Our second sufficient condition for (*) is that k be 2 and f be a light map. To prove this, the theory developed in obtaining the preceding results is combined with Federer's dimension theoretic modification procedure. To show the applicability of the latter, it is necessary to show that X is in effect connectedly separated and to obtain certain information concerning the sections of f by n-1 dimensional planes. 46 pages. $2.00. Mic 58-4350

ON SURFACES WITH A RECTILINEAR GEODESIC CIRCLE

(Publication No. 25,372)

Adriano Mario Garsia, Ph.D.
Stanford University, 1957

In the experiments designed to study the shock phenomena following the detonation of high explosives it is often useful to generate a rectilinear detonation front propagating on a plane sheet of explosive.

The problem of generating such rectilinear detonation fronts were reduced to a problem of differential geometry. A surface S has to be found, which contains a geodesic triangle FAB, such that the geodesic AB is a segment of a straight as well as an arc of a geodesic circle of S with center in F, (i.e., all the points of the segment AB have the same geodesic distance from the point F).

A detonation started at the point F of a thin layer of explosive assuming the shape of the geodesic triangle FAB of such a surface would of course reach simultaneously all points of the segment AB.

This paper is the result of an investigation on the existence of such surfaces and the possibility of the practical realization of some of them.

The work is divided into two parts. In the first part, after a few basic concepts and definitions, there is a brief analysis of the problem in its most general aspect. A mechanical construction is then given that generates a smooth model, whose parametric equations are still unknown. A class of solutions which has an edge type discontinuity of the normal is also presented along with a description of a particular surface of the kind which at the present is being used in the experiments.

However, most of the results are contained in the second part where a class of smooth solutions is obtained by taking envelopes of families of cones. This method is based on the following construction:

Let the point F be chosen in 3-space and let d be a straight line not containing F. The distance of the point F from the straight line d is assumed as a unit of measure.

Let $\{\Gamma(\psi)\}$ be a one-parameter family of surfaces which has a real envelope S and possesses the following properties:

(i) Each surface $\Gamma(\psi)$ contains both the point F and the straight line d.
(ii) Each surface $\Gamma(\psi)$ touches the envelope S along a geodesic line $\Lambda(\psi)$ which joins the point F with a point $Q(\psi)$ of d.
(iii) In each surface $\Gamma(\psi)$ the arc $\widetilde{FQ}(\psi)$ of $\Lambda(\psi)$ also gives the shortest path between the point F and the straight line d. Furthermore, the length of the arc $\widetilde{FQ}(\psi)$ is equal to the same number $\ell > 1$.

The envelope of such families $\{\Gamma(\psi)\}$ is in general a solution of the problem.

One of the advantages of this method is due to the fact that the surfaces Γ can be made special without making their envelopes any less general. In fact, all possible solutions can be obtained considering only families $\{\Gamma(\psi)\}$ consisting of ruled surfaces.

For a developable surface it is easy to describe the geodesics and therefore to assure that any of the properties, i), ii), iii), are satisfied. Nevertheless, a wide class of solutions can be obtained by taking the envelopes of families $\{\Gamma(\psi)\}$ consisting of developables. Because cones, among developables, are the easiest surfaces to deal with, in this paper it was possible to characterize all families $\{\Gamma(\psi)\}$ that consist entirely of conical surfaces.

This construction produced explicit parametric equations of surfaces belonging to a class of solutions that are characterized by assigning an arbitrary curve.

77 pages. $2.00. Mic 58-4351

A THEORY OF PSEUDOGROUPS WITH APPLICATIONS TO CONTACT STRUCTURES

(Publication No. 25,374)

John Walker Gray, Ph.D.
Stanford University, 1957

This paper is concerned with the study of collections Γ of homeomorphisms between open subsets of a topological space X which are closed under composition and formation of inverses and which satisfy the condition that if $U = \bigcup U_i$, U_i open and $f : U \to f(U)$ is 1-1, then $f \in \Gamma$ if and only if $f|U_i \in \Gamma$ for all i. Such a collection is called a pseudogroup.

The notion of a regular topological groupoid is introduced and it is shown that there exists a 1-1 functor from the category of pseudogroup homomorphisms to the category of continuous, open groupoid homomorphisms. The properties of such groupoids are exploited in the discussion of pseudogroups.

Local structures are defined and it is shown that a representation of a topological groupoid in a topological group G induces a map of the local structures on a space X into the set of G-bundles on X.

These theories are applied to the case of a local contact structure on a manifold; i.e., a structure induced by the pseudogroup of contact transformations in an odd-dimensional Euclidean space. It is shown that the existence of a local contact structure implies a reduction of the

group of the tangent bundle to U(n). Sufficient conditions for the existence of such a reduction are given in dimensions 3, 5, and 7.

Left-invariant contact structures on Lie groups are discussed and it is shown that a semi-simple Lie group admits such a structure only if it is simple. Finally, contact transformations on a manifold are discussed and it is shown that, as in the classical case, the group of contact transformations is infinite dimensional.

98 pages. $2.00. Mic 58-4352

VACUUM EXPECTATION VALUES

(Publication No. 23,827)

Douglas Weir Hall, Ph.D.
Princeton University, 1956

The vacuum expectation value of the product of n scalar fields : $F^{(n)}(x_1, \cdots, x_n) = \left(\Psi_0, \phi(x_1) \cdots \phi(x_n) \Psi_0\right)$ is considered as the boundary value of an analytic function $F^{(n)}(z_{ij})$ in 4(n-1) complex variables.

The invariance properties of $F^{(n)}(z_{ij})$ which are deducible from those assumed about ϕ and the vacuum Ψ_0 enable $F^{(n)}(z_{ij})$ to be written as an analytic function of scalar products (Theorem 2). The domain of analyticity of $F^{(3)}(z_{12}, z_{23})$ written as a function of $z_{12}^2, z_{23}^2, (z_{12} + z_{23})^2$ is extensively investigated. The assumption that ϕ is local implies that $F^{(3)}$ is a symmetric function in these variables.

It is shown that the analytic function $F^{(n)}(z_{ij})$ may be written as a weighted integral of a "Universal Singular" function $\Delta(M)$, which is an analytic function of the matrix elements of the matrix M, which is invariant under the substitution $M \rightarrow \Lambda_1 M \Lambda_2$ (Λ_i Lorentz transformations). This invariance property enables it to be shown that $\Delta(M)$ is an analytic function of "trace variables": $T_r A, T_r A^2, \cdots$ where $A = M^T M$ (Theorem 4). An investigation is also made of Δ by writing it in terms of known functions for special cases.

The free field and "Ward" theory are considered as examples to illustrate the above investigation.

182 pages. $2.40. Mic 58-4353

ON THE DIFFERENTIAL GEOMETRY OF HOMOGENEOUS SPACES

(Publication No. 24,143)

Robert Hermann, Ph.D.
Princeton University, 1956

The problem of investigating the existence of homogeneous almost-complex structures on simply connected compact homogeneous spaces of positive Euler-Poincare characteristic is proposed, and is shown to lead to various differential-geometric, group-theoretical and topological problems. As a result of the partial solution of these problems, it is shown that 1) there are seven compact homogeneous spaces, quotients of an exceptional compact simple Lie group by a non-symmetric maximal semi-simple subgroup which do admit homogeneous almost complex structures, generalizing the fact that S_6 admits an almost complex structure and 2) the quaternion projective spaces admit no homogeneous almost-complex structures, while the complex projective spaces of even dimension can admit only one homogeneous almost complex structure.

Finally, the existence of tangential k-spreads on complex and quaternion projective spaces is investigated using the tools of the Steenrod powers and the characteristic classes, leading to results generalizing those of H. Hopf and E. Kundert on the subject.

70 pages. $2.00. Mic 58-4354

STEADY FLOW OF SLIGHTLY VISCO-ELASTIC FLUIDS

(Publication No. 23,445)

William Edwin Langlois, Ph.D.
Brown University, 1957

The steady flow of visco-elastic fluids for which the stress-deformation relation departs only slightly from that of a Newtonian fluid is considered. Incompressibility of the material is assumed throughout and the analysis is limited to flows for which inertia terms in the equations of motion may be neglected.

A theorem is proved in order to provide a method of studying the effect of a small departure of the stress-deformation relation from that of a Newtonian fluid upon flows of a very viscous fluid. It is shown that if the slightly visco-elastic fluid is in a state of steady flow with fixed sources or sinks present within the volume occupied by the fluid or on fixed portions of its boundaries, which are assumed to consist solely of rigid walls at rest or in steady motion parallel to themselves, then an approximate solution to the governing equations and boundary conditions can be found by the following procedure:

(i) a solution (v_i', p') to the equations of motion for an incompressible Newtonian fluid is calculated neglecting inertia subject to the boundary conditions of the situation;

(ii) the solution (v_i', p') calculated in (i) is introduced into the equations of motion for the incompressible visco-elastic fluid and the additional body forces required to support this solution are calculated neglecting inertia;

(iii) a solution (v_i'', p'') to the equations of motion for an incompressible Newtonian fluid under the action of the body forces calculated in (ii) is calculated neglecting inertia, subject to the boundary conditions of vanishing velocity at the walls, of zero efflux from the sources, and of zero flux across surfaces across which the volume flow is prescribed;

(iv) then ($v_i = v_i' - v_i''$, $p = p' - p''$) is an approximate solution to the equations of very slow motion for an incompressible, slightly visco-elastic fluid subject to the same boundary conditions as used in (i). The error involved is of the second order in a dimensionless parameter which measures the departure of the stress-deformation relation for the material from that of a Newtonian fluid.

This theorem is then applied to the investigation of three specific flow problems.

Previous authors have established that rectilinear flow in an infinitely long tube of elliptical cross section is

possible only for materials with rather special stress-deformation relations: in the general case, a secondary flow in the corss-sectional planes is superimposed on the flow down the tube. The nature of this secondary flow is discussed in the present work.

The flow generated by a line sink at the vertex of a wedge-shaped region and its axially symmetric analogue, the flow generated by a point sink at the vertex of a cone, are also considered. It is shown that purely radial flow occurs only as a special case: the flow is generally characterized by eddies near the vertex of the wedge or cone.

Some mathematical results relevant to the study of flows with axial symmetry are developed for reference.

110 pages. $2.00. Mic 58-4355

THE PROBLEM OF MILLOUX FOR FUNCTIONS ANALYTIC IN AN OPEN ANNULUS

(Publication No. 23,447)

Charles Joseph Lewis, Ph.D.
Brown University, 1957

1. Statement of the problem. Let the annulus $[0 < s < |z| < 1]$ be denoted by A; let $\mathcal{E}$ denote a set of points in A, closed relative to A, such that $[|z| = \rho] \cap \mathcal{E} \neq \phi$ for all ρ satisfying: $s < \rho < 1$. Let m be a positive number less than one; and let $\mathcal{F}_m$ denote the family of functions g which are defined, analytic, and of modulus less than one on A, and each one of which has an associated $\mathcal{E}$-set with the property that $z \in \mathcal{E}$ implies $|g(z)| \leq m$. Finally, let $M(g;r) = \max_{|z|=r} |g(z)|$. The problem of Milloux is to determine, for r satisfying: $s < r < 1$,

$$\max_{g \in \mathcal{F}_m} M(g;r),$$

and the corresponding extremal functions. Since $\mathcal{F}_m$ is a normal family, such an extremal function exists for any indicated value of r, and it is a member of $\mathcal{F}_m$.

2. Properties of the extremal function. It is shown that if f is an extremal function for the problem stated above, and if the normalization $f(r) = M(f;r)$ is made, then f has the following properties:

(a) f is unique and independent of r;
(b) f has an infinite number of zeros, all simple and negative; -1 and -s are both cluster points of the zeros; each zero a_i is mapped into another zero b_i by the map $z \longrightarrow s/z$;
(c) f is real for z real;
(d) on the real axis between successive zeros of f there exists a unique point where $f^2 = m^2$;
(e) $f(-\sqrt{s}) = m$, $f'(-\sqrt{s}) = 0$;
(f) f′ has simple zeros at the points whose existence is affirmed in (d) in addition to the simple zero at $-\sqrt{s}$ which is noted in (e);
(g) the zeros of $f^2 - m^2$ are $z = -\sqrt{s}$ and the points defined in (d), and there are no others.

The proof of the above assertions is effected in four steps: first, the extremal function f is compared with a competing candidate F, all of whose zeros are negative real, with the same respective moduli and multiplicities as those of f. It is shown that $f \equiv F$, and that $[-1 < z < -s]$ is an $\mathcal{E}$-set for the extremal function, which is unique and real-valued for z real. Next, a function Ψ is introduced, which is an analytic, (1,2) map of A onto $[|w| < 1]$. Then, the composition $\phi \circ \Psi$ is formed, wherein ϕ is the extremal function for the corresponding problem of Milloux for $[|w| < 1]$, and whose properties were investigated by Heins [5,6].[1] Finally, a lemma due to Robinson [19] is invoked, to show that $f \equiv \phi \circ \Psi$.

3. Explicit representation of the extremal function f, and determination of M(f;r). The extremal function f has two independent parameters: m and s. The independence is emphasized in the composition $\phi \circ \Psi$, since $\phi(w) = \phi(w;m)$ and $\Psi(z) = \Psi(z;s)$. Heins has shown that, with m preassigned,

$$(3.1) \qquad m = \prod_{k=0}^{\infty} \left(\frac{1 - \tau^{2k+1}}{1 + \tau^{2k+1}}\right)^2$$

may be solved for unique τ satisfying: $0 < \tau < 1$. Further, if the Jacobi theta functions

$$\theta_3(u,\tau) = C \prod_{k=0}^{\infty} (1 + 2\tau^{2k+1} \cos 2\pi u + \tau^{4k+2}),$$

and

$$\theta_4(u,\tau) = C \prod_{k=0}^{\infty} (1 - 2\tau^{2k+1} \cos 2\pi u + \tau^{4k+2}),$$

(C independent of u) are introduced, then, with $\cos 2\pi u = (1-w)/(1+w)$, ϕ has the representation

$$(3.2) \qquad \phi(w;m) = \theta_4(u,\tau)/\theta_3(u,\tau).$$

To obtain an explicit representation of Ψ, the S-function with parameter s satisfying: $0 < s < 1$, is introduced by

$$S(z;s) = \prod_{n=0}^{\infty} (1 - s^{2n}z) \prod_{n=1}^{\infty} (1 - s^{2n}/z).$$

It is shown that

$$(3.3) \qquad \Psi(z;s) = z \left\{\frac{S(-s^{3/2}z)}{S(-s^{1/2}z)}\right\}^2.$$

Then, with $\cos 2\pi u = [1-\Psi(z;s)]/[1+\Psi(z;s)]$, f has the representation

$$f(z;m,s) = \theta_4(u,\tau)/\theta_3(u,\tau).$$

To determine M(f;r), calculate τ from (3.1), and calculate $\Psi(r;s)$ from (3.3). With $\cos 2\pi u_0 = [1-\Psi(r;s)]/[1+\Psi(r;s)]$, (3.2) yields

$$M(f;r) = f(r;m,s) = \phi[\Psi(r;s);m] = \theta_4(u_0,\tau)/\theta_3(u_0,\tau).$$

74 pages. $2.00. Mic 58-4356

1. Numbers in the square brackets refer to citations in the Bibliography of the dissertation.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

CONTINUOUS PRODUCTS AND NONLINEAR INTEGRAL EQUATIONS

(Publication No. 25,186)

John William Neuberger, Ph.D.
The University of Texas, 1957

Supervisor: Professor H. S. Wall

This paper deals with the solution of integral equations in an abelian, normed and complete space L, the points of which constitute S. $\int_c^t dH \cdot X$ is defined over an interval W, with H a function from W into the set B of all transformations from S into S and X a function from W into S. T is the function from WxW into B such that $T(k,m)p = [H(k) - H(m)]p+p$ for all p in S. The "continuous product from c to t of the point A of S with respect to H" is a point K of S such that, if $\epsilon > 0$, there is a monotone sequence J from c to t such that, if $[c,t_2, \cdots, t_n,t]$ is a monotone refinement of it, then $\|T(t,t_n)T(t_n,t_{n-1})\cdots T(t_3,t_2)T(t_2,c)A-K\| < \epsilon$. It is shown that if $\|[H(k)-H(m)]p-[H(k)-H(m)]q\| \leqq V_1(k,m)\|p-q\|$ and $\|[H(k)-H(m)]p\| \leqq V_2(k,m)$ for continuous functions V_1 and V_2, with $V_i(a,b)+V_i(b,d) \leqq V_i(a,d) = V(d,a) \geqq 0$, i=1 and 2, $a \leqq b \leqq d$, and for all p,q in some bounded region containing A, then, for some subinterval W′ of W containing c, the only continuous function Y from W′ into S such that $Y(t) = A+\int_c^t dH \cdot Y$ can be exhibited for each t in W′ as the above defined continuous product from c to t. If S is Euclidean n-space, H can be chosen so that this integral equation is equivalent to a certain system of n first order nonlinear differential or integral equations. A method of computation for such a system is inherent in the argument.

41 pages. $2.00. Mic 58-4357

COOPERATIVELY DEVELOPED CRITERIA FOR HIGH SCHOOL MATHEMATICS PROGRAMS

(Publication No. 24,485)

Colbert Thaxton Purvis, Ph.D.
George Peabody College for Teachers, 1957

Major Professor: F. Lynwood Wren

The purpose of this study was to employ a consensus of the thinking of a group of authorities in mathematics education as a basis for the development of a set of criteria for evaluating high school mathematics programs. This thinking was obtained through: (1) professional literature, (2) individual correspondence and conferences, and (3) questionnaires, on which individuals indicated their opinions of the worth of the proposed criteria. Two hundred fifteen jurors and eighty-five Georgia schools and colleges cooperated.

The "final" set of criteria developed in the study consists of a subset of eighty-four items of "subjective" criteria relating to qualities and practices of mathematics programs and teachers, and a subset of sixty-five items of mathematics subject matter content. The final test to which the criteria were subjected was their use in the evaluation of the mathematics programs of thirty-eight Georgia high schools. Whereas the ratings assigned by jurors were limited to worth ratings, those assigned by these participating schools included: (1) worth ratings; (2) achievement ratings, indicating the extent to which schools measure up to the criteria; and (3) mastery ratings, indicating the extent to which pupils master the specified mathematical operations and concepts.

Findings

The jurors and Georgia teachers found the final set of criteria to be of satisfactory scope. They agreed that it constitutes a defensible instrument for use by a school to evaluate its mathematics program and by a mathematics teacher to study his courses and teaching. Georgia teachers awarded somewhat higher worth ratings to the subjective criteria than did the jurors. The jurors assigned higher ratings to the items of content than did the teachers.

The schools whose mathematics programs were evaluated constituted approximately one-fifth of the white public and private high schools in the state of Georgia which were accredited by the Southern Association of Colleges and Secondary Schools for the year 1954-1955. In that year the number of years of mathematics offered in these participating schools ranged from three to seven and one-half. There were 220 mathematics courses in the 38 schools. Of these, 166 were taught for a full school year, and 54 for one-half year. All of the schools seek to serve preparatory pupils through two years of algebra and one of plane geometry. Solid geometry was taught in nine of the schools, "advanced" or "senior" algebra in twenty-three, trigonometry in twenty, and some type of "general" or "practical" mathematics in thirty-one.

The content of the first two years of algebra was usually restricted to arithmetic and those algebraic concepts which are normally associated with these courses. Plane geometry, solid geometry, trigonometry, and advanced algebra were often found to include a wide variety of topics not associated therewith. The mathematical content of the general courses was usually limited to arithmetic—arithmetic which the reporting teachers asserted should have been mastered before the pupils reached high school. The general courses were regarded as inferior expedients, for the slowest pupils.

Pupils preparing to study mathematics, science, or engineering in college were given above-average mastery ratings by at least 50 per cent of the schools for forty of the items of content; other preparatory pupils, for twenty-four; and all other pupils, for only three elementary items.

The jurors and teachers agreed that the cooperative approach employed in this study is appropriate for the development of criteria for high school mathematics programs.

379 pages. $4.85. Mic 58-4358

INTEGRATION OF BOUNDARY VALUE PROBLEMS FOR PARABOLIC EQUATIONS BY DIFFERENCE METHODS

(Publication No. 24,889)

Murray B. Ritterman, Ph.D.
New York University, 1955

Adviser: Professor F. John

This paper concerns itself with the problem of how certain parabolic differential equations with initial and boundary values imposed can be solved by replacing them with suitable difference equation probelms defined over a set of lattice points and then taking the limit of the solutions of these problems as the mesh size tends to zero. Specifically linear and quasilinear equations for a function u(x,t) of the form

$$\frac{\partial u}{\partial t} = a_0(x,t)\frac{\partial^2 u}{\partial x^2} + 2a_1(x,t)\frac{\partial u}{\partial x} + d(x,t,u)$$

are treated where initial values u(x,0) are prescribed and where in addition boundary conditions of the form

$$\frac{\partial u}{\partial t} = \alpha_i(t)\frac{\partial u}{\partial x} + \gamma_i(t,u) \qquad i = 0,1$$

are imposed at x = 0,1.

Associated with the differential equation is the difference equation

$$u_t = a_0 u_{x\bar{x}} + 2a_1 u_x + d$$

for a function u(x,t,h) defined over a rectangular lattice with initial values u(x,0,h) prescribed and with boundary conditions

$$u_t = \alpha_0(t)u_x + \gamma_0(t,u) \qquad \text{at } x = 0$$

$$u_t = \alpha_1(t)u_{\bar{x}} + \gamma_1(t,u) \qquad \text{at } x = 1$$

imposed. (The subscript x is for forward x difference, $\bar{x}$ for backward x difference and $x\bar{x}$ for central second difference.)

The main objective of the paper is to derive sufficient conditions under which u(x,t,h), the solution of the associated difference equation converges to a function u(x,t) and then to determine what further conditions are needed to guarantee that u(x,t) is a solution of the original differential equation problem.

Neither the existence nor the uniqueness of the solution of the differential equation problem is assumed. Theorems establishing existence and uniqueness are derived as a result of the difference methods employed.

The main theorem proved shows that if $a_0 > 0$, $\alpha_0 > 0$, $\alpha_1 < 0$, and if a certain quantity called the mesh ratio is small enough, then u(x,t,h), the solution of the difference equation converges to a function u(x,t) provided the initial values are continuous and provided the coefficients in the equations are regular enough. For the coefficients it is assumed that a_0 has third derivatives, a_1, α_0, and α_1 have second derivatives, and that d and γ_i possess continuous derivatives with respect to the t and u arguments. If in addition the initial values possess a second derivative then the function u(x,t) is a solution of the original differential equation problem. 43 pages. $2.00. Mic 58-4359

FLOWS WITH FREE BOUNDARIES IN A TUBE

(Publication No. 25,386)

Eugene Richard Rodemich, Ph.D.
Stanford University, 1957

This paper treats axially symmetric fluid flows in a tube from a mathematical viewpoint. The fluid is assumed to be inviscid and incompressible. It follows that the stream function ψ of an irrotational flow satisfies the linear elliptic differential equation

$$\frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} - \frac{1}{y}\frac{\partial \psi}{\partial y} = 0,$$

if (y, θ, x) are cylindrical coordinates, with y the radial distance.

The first form of problem considered is the following: The flow region is bounded by an infinite cylinder of radius 1 with a finite constriction satisfying certain symmetry properties. The problem is to show that a flow through the cylinder exists, which has a free boundary between two given symmetrically located points on the constriction, the points of separation.

It is shown that this flow always exists if the constriction is flat between the points of separation. The free boundary obtained for this case is also appropriate for any other behavior of the constriction between the points of separation. If the constriction projects into the region between this free boundary and the axis, then no free boundary flow of the desired type exists.

The flow is obtained as the solution of a minimum problem. With velocity 1 at $x = \pm\infty$,

$$\psi = \frac{1}{2} = \frac{1}{2}y^2 + \dots$$

there. The quantity minimized is

$$M - (\lambda-1)V = \iint_D \left(\nabla\psi + \frac{1}{2}\nabla y^2\right)^2 \frac{dxdy}{y} - (\lambda-1)\iint_V y\,dxdy,$$

which can be interpreted as the Lagrangian of the flow. D is the region of the upper half of the xy-plane which generates the flow region by rotation about the y-axis. V is the portion of $0 < y < 1$ which lies outside of D. The coefficient $\lambda-1$ is so written because λ is the square of the resulting velocity along the free boundary. The domains D admissible for the minimum problem are formed by taking the given boundary outside of the points of separation, and joining these two points by any curve which lies in the rectangle determined by these points and the axis.

It is shown that a solution to the minimum problem exists. The minimizing curve is an open analytic arc which may be connected to the points of separation by vertical or horizontal line segments. These segments occur when λ is chosen too large or too small. For a proper choice of λ, the points of separation are joined by an analytic arc which is a free boundary. The condition that the velocity is constant along this curve for the minimum domain is obtained by applying a variation of the boundary and using the minimal property of the domain.

Flow from a nozzle is obtained by taking the limit as the distance between the points of separation becomes infinite. 65 pages. $2.00. Mic 58-4360

SOME RESULTS CONCERNING TRANSFORMATION RINGS WHICH SATISFY VARIOUS DENSITY CONDITIONS

(Publication No. 25,280)

Norman Emil Sexauer, Ph.D.
University of Illinois, 1957

If (F, V) is a linear manifold, L(F, V) will denote the full ring of linear transformations of V and $L_\tau(F, V)$ will denote the two-sided ideal of L(F, V) which consists of all transformations of rank less than χ_τ. If V has infinite rank it is known that the proper two-sided ideals of L(F, V) have the form $L_\tau(F, V)$ for some ordinal τ.

A ring E(F, V) of linear transformations of a linear manifold (F, V) is said to be τ-dense if to every set of less than χ_τ linearly independent vectors a_j and any set of vectors b_j such that the indices of the two sets are in one-one correspondence, there exists an element in E(F, V) that maps a_j onto b_j for all j.

If R is an arbitrary ring and J a subset of R then the totality $\mathfrak{L}(J)$ of elements x in R such that xJ = 0 is a left ideal and such a left ideal will be called a left annulet. Right annulets $\mathfrak{R}(J)$ are defined in a similar manner. The totality of left (right) annulets of R is a lattice. By the rank and co-rank of an annulet is meant the lattice rank and co-rank.

Consider the following conditions.

(1) If R_0 is the socle of R then $R_0 \neq 0$, $R_0^2 \neq 0$ and R_0 is contained in every non-zero two-sided ideal of R.

(2) If S is a left annulet of R and $\mathfrak{R}(S) = 0$ then S contains R_0.

(3) If S, T are left annulets of R such that $S \cap T = 0$ and both have rank χ_μ ($\mu < \tau$) then there exists σ in $\mathfrak{R}(S)$ such that $\tau\sigma = \tau$ for all τ in T.

(4) If left annulet S of R has co-rank χ_μ ($\mu < \tau$) then there exists σ in R such that $\mathfrak{L}(\sigma)$ is contained in S and $\mathfrak{R}\mathfrak{L}(\sigma)$ has co-rank less than χ_τ.

Let V have infinite rank. Then it is known that an arbitrary ring R is isomorphic to a ring E(F, V) of linear transformations of V containing $L_0(F, V)$ if, and only if, (1) and (2) hold.

The main results obtained may be stated as follows:

R is isomorphic to a ring E(F, V) of linear transformations of V containing $L_0(F, V)$ and which is τ-dense if, and only if, (1), (2) and (3) hold.

R is isomorphic to a ring E(F, V) of linear transformations of V containing $L_\tau(F, V)$ if, and only if, (1), (2), (3) and (4) hold.

Conditions have also been found on V which characterizes the above rings.

The main tool used in the investigation is the Galois correspondence as developed by Baer and extended by Wolfson between the annulets in the transformation ring and the subspaces of V. Using this correspondence various characterizations of a O-dense ring of linear transformations which contain transformations of finite rank have been obtained. Several characterizations of a ring of linear transformations which contains $L_0(F, V)$ have also been obtained.

If E(F, V) is a ring of linear transformations, $E_\tau(F, V)$ will denote the totality of all transformations in E(F, V) which have rank less than χ_τ. If the rank of V is not less than χ_τ and $\tau \geq 1$ then: $E_\tau(F, V)$ is τ-dense if, and only if, (i) for each ordinal $\mu < \tau$ there exists an element in $E_\tau(F, V)$ of rank $\geq \chi_\mu$ and (ii) E(F, V) is τ-dense. This generalized a result in the finite case.

Finally the left annulets of the proper two-sided ideals of the full ring of linear transformations have been characterized. 36 pages. $2.00. Mic 58-4361

VARIATIONAL METHODS IN CONFORMAL MAPPING WITH APPLICATIONS TO HYDRODYNAMICS

(Publication No. 25,389)

Peter William Shaw, Ph.D.
Stanford University, 1957

This paper is divided into two parts. Both parts are treated by variational methods. Part I solves a problem in conformal mapping, while part II deals with a problem in hydrodynamics. The conformal mapping problem is concerned with the outer radius $\bar{r}$, the area A and the diameter d of a continuum E. The dimensionless functional

$$J(E,\lambda) = \log \bar{r} - \lambda \log A - (1-2\lambda)\log d$$

is formed for every continuum E and each fixed λ. We first show the existence of a region E which minimizes the functional $J(E,\lambda)$ and then we derive the conformal map of $|z| > 1$ onto the exterior D of the minimal region E. Calculating $\bar{r}$, A and d for the extremal domain we arrive at the family of inequalities

$$\log \bar{r} \geq \frac{q^2 - 1 - 2\log q}{2(q+1)^2} \log \frac{q^2 A}{\pi(q^2 - 1 - 2\log q)} + \frac{2(q + 1 + \log q)}{(q+1)^2} \log \frac{qd}{2(q + 1 + \log q)}, \quad 1 \leq q \leq \infty.$$

We then show that if the parameter q is chosen to satisfy the equation

$$\frac{d^2}{A} = \frac{4(q + 1 + \log q)^2}{\pi(q^2 - 1 - 2\log q)},$$

we obtain a sharp lower bound for $\bar{r}$. This sharp lower bound may be written

$$\bar{r} \geq \frac{qd}{2(q + 1 + \log q)}.$$

The well-known results

$$\bar{r} \geq \frac{d}{4}$$

and

$$\bar{r} \geq \left(\frac{A}{\pi}\right)^{1/2}$$

are obtained for the special parameter values q=1 and $q=\infty$ respectively.

Part II treats the axially symmetric reentrant jet flow about a disk perpendicular to a uniform stream. The free boundary is shown to be the surface minimizing a certain combination of virtual mass and volume. An estimate for the drag on the disk is then obtained, expressing it in terms of this minimal quantity.

77 pages. $2.00. Mic 58-4362

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

ALGEBRA, A MODERN SECONDARY SCHOOL SUBJECT

(Publication No. 24,487)

James Richard Smart, Ph.D.
George Peabody College for Teachers, 1957

Major Professor: F. Lynwood Wren

This study sought to determine the place of algebra as a modern secondary school subject. Recommending changes through which algebra may become a more modern secondary school subject was the second major purpose of the investigation. A survey of the literature of algebra education in the postwar period, personal correspondence, and textbook analysis provided the means for attacking the expressed problem.

Findings of the Study

Algebra is no longer a universal subject; today, secondary algebra is constantly on the defensive. Paradoxically, increasing needs for trained personnel in algebra have been accompanied by the removal of many groups from the algebra classroom. Present problems of algebra education include the critical manpower shortage, a program for gifted and poorly prepared students, teacher education, coordinating algebra in schools and colleges, modern teaching techniques, placement of algebra in the curriculum, adjusting algebra to student needs, and introducing modern abstract algebra into the secondary schools.

The general objectives of algebra today include teaching algebra as a functional or tool subject, as a subject designed to train for logical thinking, and as a cultural subject. Investigation to determine the type of algebra needed by groups of secondary students has been centered almost exclusively upon the objective of functionality. This study analyzed the algebra of a modern, functional program for engineers, scientists, mathematics teachers, mathematics majors, college students in general, workers in business and industry, military personnel, and citizens. Textbook analysis yielded the algebraic prerequisites for a beginning course in modern algebra: a great deal of notation, understanding of fundamental concepts, but less emphasis than usual upon manipulative techniques.

The algebra of classes and methods of proof exemplify algebraic material for the attainment of logical objectives. Fundamental ideas like mathematical systems and definitions offer promise for attaining cultural objectives; modern algebra is essential to transmit the culture of recent centuries. Textbooks emphasizing logical and cultural values in mathematics contain much algebra of a modern nature.

Many arguments based on the opinion of authorities, analysis completed in this dissertation, and the existing shortcomings of algebra support the need for modernizing secondary algebra. Plans to introduce some modern algebra into the secondary curriculum, particularly such topics as a postulational development of the number system, groups, set theory, and matrices, are quite feasible and highly desirable. High school preparation for modern algebra may be achieved by following an analysis of prerequisites.

Much of the material of traditional algebra is still valuable for many secondary students. This study showed ways in which modern topics of algebra may be adapted to the high school level. Three outlines for experimental high school courses in modern algebra grew out of the investigations of prerequisites. One course followed the outline of a standard modern algebra text, and included only those topics from traditional algebra which were necessary for the postulational development of the number system and the theory of groups. The second outline merely inserted modern topics into a traditional sequence. The third presented topics designed to achieve logical and cultural objectives.

The study showed that algebra is not doomed as a secondary subject. Algebra is more important today in its applications than ever before. If the subject can be modernized, particularly by the introduction of topics from modern abstract algebra, algebra will remain a significant discipline, ideal for retention in the modern secondary school curriculum. 316 pages. $4.05. Mic 58-4363

CLASSIFICATION OF FINITE 2-COMPLEXES

(Publication No. 23,888)

Emmet Finlay Whittlesey, Ph.D.
Princeton University, 1956

Form a 2-complex K by "gluing" finitely many 2-cells on a connected 1-complex so that each oriented cell-boundary is mapped piecewise into a cycle in the 1-complex. Assume each 0- or 1-cell is incident with some 2-cell (but this restriction can later be removed). By "cut-and-paste" operations like those used for surfaces (see Lefschetz, Introduction to Topology, pp. 72-84) such a 2-complex K can be reduced to canonical form K* consisting of one or more surface components of the type $\alpha d_1 \beta_1 d_1^{-1} \ldots d_r \beta_r d_r^{-1}$, where $\alpha = a_1 b_1 a_1^{-1} b_1^{-1} \ldots a_p b_p a_p^{-1} b_p^{-1}$ or $c_1 c_1 \ldots c_q c_q$ according as the surface component is orientable or not and where the β's are blocks of alternating capital and small letters denoting vertex and edge singularities (including boundary curves as particular edge singularities). K and K* are equivalent, combinatorially and topologically. K is classified by certain invariants, partly numerical and partly of order. Arbitrary finite 2-complexes are finally considered, and the mode of presentation generalized to allow arbitrary finite sequences of small and capital letters. The fundamental group is studied and the relationship of the present classification to the isomorphism problem for finitely presented groups is studied. The groups of 2-pseudomanifolds are computed. 145 pages. $2.00. Mic 58-4364

ON LINE COMPLEXES IN A PROJECTIVE FOUR-SPACE

(Publication No. 25,314)

Peter Yff, Ph.D.
University of Illinois, 1957

H. R. Brahana has begun the classification of metabelian groups having five generators, in which every element except the identity is of order p (an odd prime), and in which the commutator subgroup coincides with the center.

There is a unique group G of order p^{15} satisfying these conditions. All other groups of this kind are quotient groups of G with respect to subgroups of the commutator subgroup C. These groups are defined by imposing conditions on the generators of C.

It is known that the Plücker coordinates of a line in a projective four-space designate a point in a projective nine-space. The set of points in the nine-space which represent lines in the four-space is a six-dimensional hypersurface. An earlier paper by J. A. Todd presents a study of line complexes in a four-space from this point of view.

In a group of the kind being considered, any element not in the commutator subgroup corresponds to a point in a finite projective four-space X. The commutator of two elements corresponds to the line joining their respective points, and this line determines a point in a nine-space S. The set of points in S corresponding to lines of X is called V. Linear subspaces of S may be classified according to their relations to V and X. Each linear subspace corresponds to a quotient group of G, and two such groups are simply isomorphic if and only if their corresponding subspaces in S are conjugate under a collineation originating in X.

Brahana listed the different types of points, lines, planes, and three-spaces in S. These correspond respectively to groups of orders p^{14}, p^{13}, p^{12}, and p^{11}. The present paper begins the classification of four-spaces in S. In particular, four-spaces having no point on V are investigated.

Each point of X determines a unique eight-dimensional hyperquadric in S, which intersects a four-space of this kind in a three-dimensional hyperquadric. Thus the four-space contains a four-parameter system of hyperquadrics determined by the points of X. It is shown here that the four-parameter system in a four-space not meeting V contains no degenerate hyperquadrics.

Each point of S not on V determines a unique three-space in X. The points determining a given three-space lie in a unique five-space Σ in S. A line in such a five-space is called a Σ-line. It is shown that a four-space with no point on V contains no Σ-line.

It follows that the three-spaces in such a four-space are all of one type. It is shown that a three-space of this type can be transformed into itself or into any other three-space of the same type in exactly five ways, by means of collineations of X.

Given a three-space of this type, two four-spaces are exhibited which contain the three-space and have no point on V. It is shown that the three-spaces in such a four-space are indistinguishable in the sense that any one may be mapped onto any other by a collineation of X which leaves the four-space fixed. Moreover, it is shown that the four-space must always remain fixed when one of its three-spaces is left in the four-space by a collineation of X.

A direct consequence of this is that the two four-spaces which were found are of different types. They correspond to two groups of order p^{10} which are not isomorphic although their proper subgroups are in one-to-one correspondence and are respectively isomorphic.

It is not known whether there exist four-spaces of other types which have no point on V.

38 pages. $2.00. Mic 58-4365

THE CONCEPT OF TONALITY IN THE OPERAS OF JEAN-PHILIPPE RAMEAU

(Publication No. 25,188)

Emil Gustave Ahnell, Ph.D.
University of Illinois, 1957

As a theorist, Jean-Philippe Rameau (1683-1764) both codified and expanded the harmonic procedures of his time. His theories (which are summarized in Chapter I) deal primarily with an attempt to prove that all music is generated from one fundamental sound. Throughout his life, he wrote numerous treatises in which he constantly revised his ideas — even to the point of contradiction — in order to find a scientifically based mathematical foundation for his beliefs. Finally, Rameau succumbed to tempered tuning because it allowed false consonances which he could not account for in any other manner. His main contributions in the field of theory are the establishment and recognition of chord-inversion, the presentation of functional harmony, the relationship of the relative minor to the major, and the concept of a fundamental bass. The latter, containing only chord roots, is an imaginary bass underlying all harmonies of a composition.

In his five lyric-tragedies (Hippolyte et Aricie, Castor et Pollux, Dardanus, Zoroastre, and Les Boréades) Rameau utilizes his compositional theories of dissonance, counterpoint, cadences, and melodic writing quite consistently. From harmonic and tonal points of view, he follows several basic modulatory patterns in the organization of his musical ideas. These are the ones found in the binary, ternary, and rondeau forms of instrumental dances. Although not conforming with them in melodic construction, the relationship of their modulatory patterns to the ones in dance pieces has caused the author to label them "tonal forms." This tonal organization underlies even the recitatives and ariosos which are usually considered "formless." Most frequently, the interval of modulation conforms with Rameau's belief that pieces expressing joy, love, vigor, etc. should proceed to the region of the dominant, while those expressing sadness, despair, etc. should be in the region of the subdominant. In the extended recitatives and ariosos several of these tonal forms are found in juxtaposition.

The recitatives fall into various categories which are compatible with the text. Short ones are used for dramatic interruptions, anticipations, questions; longer ones occur in sections dealing with conflict or the resolution of conflict. The degree of dramatic action is also related to the individual pieces. The ariosos and recitatives contain most of the action, while the airs and ariettes (arias) contain little or none.

The most interesting facet of Rameau's tonal procedure lies in the overall organization of the scenes and acts. His

tonal plans frequently follow intervallic patterns, usually thirds or fourths, which function as an integral part of a section in the "tonal form." These sections are then juxtaposed and constitute a two- or three-part form usually following the modulatory pattern of binary, ternary, or rondeau forms. For example, the first act of Hippolyte et Aricie (modulating D-G-D-F-D-G-D-F-D) is in a rondeau form, and the first act of Zoroastre (modulating G-D D-G) is in a binary one. At times the exact modulatory aspects of the forms are not retained, but a distinct division of tonality according to the drama is always prevalent. The ballet part of the opera (divertissement) is in one tonality and the action is in another. In all cases, except in the divertissements, the harmony is expressive of the text, which is Rameau's primary aim.

285 pages. $3.70. Mic 58-4366

TEXTURES IN TWENTIETH CENTURY ORGAN COMPOSITIONS. A STUDY OF SELECTED RECITAL WORKS.

(Publication No. 25,140)

Ramona Cruikshank Beard, Ph.D.
Columbia University, 1957

A study of textures in organ music contributes to our knowledge of organ composition by making available a conspectus of examples, a discussion of textural practices, and a formulation of the principles of usage. The study has value for all those interested in organ music whether composer, teacher, performer, listener or musicologist, since little or no emphasis has been given to the subject of textures in organ music. In composition the term textures refers to the technique of arranging notes in vertical and horizontal space to represent the sonorities which express the idea.

The steps necessary in assembling data for the study included: (1) discriminating selection of organ compositions based on a criterion of use in recital, (2) classification of patterns under the accepted types of textures: monophonic, homophonic and polyphonic, (3) classification of textural practices in relation to the character of the composition as indicated by the title, thematic material, structure or form and principles of unity and variety, and (4) analysis of all data for the purpose of formulating principles regarding uses of textures.

The study is limited to the works of nineteen composers of the twentieth century whose works appear as often as three or more times on the annual surveys of organ compositions used in recital from 1942 to 1951. The survey, conducted by H. J. W. MacCormack, was reported in The Diapason. Works of six composers of the nineteenth century serve as background for the discussion of twentieth century practices. The selected compositions provide examples of practices which are suitable for the instrument and acceptable to both performer and listener.

Trends in music in general, romanticism, impressionism and neo-classicism, are reflected in organ composition. Though polyphonic texture is present in organ music of both centuries, the use of homophonic texture predominates.

The organ design of the twentieth century permits stylistic interpretation of organ literature of all periods by incorporating the best of the "symphonic" development of the nineteenth century and of "baroque" principles of the contemporary neo-classic revival. Improved organ construction is reflected in the expansion of performing techniques.

No new textures appear, but there are new uses and types of textural patterns which include extended ranges of voice parts, thick textures resulting from added notes, doubled and tripled lines tending toward a more linear style than that of the nineteenth century. The character of twentieth century works is suggested by descriptive titles while nineteenth century titles are those of absolute music.

Eight principles regarding uses of textures are formulated, showing that in organ composition the emphasis moves from one texture to another. On the basis of findings, monophonic texture, for instance, has only incidental use, while homophonic and polyphonic textures generally serve polythematic and monthematic works, respectively. Textural patterns comprise (1) a single tone line in monophonic texture, (2) two or more voice lines in homophonic texture with a principal melody, found in any register, accompanied by varied textural patterns and (3) two or more melodies combined in polyphonic texture with imitative entrances and canonic imitation predominating. There are co-ordinate and figural lines, chordal figurations and chordal "streams" or parallelism. Textural patterns sometimes have external associations. They emphasize structural design, modify thematic material and extensions, and by repetition and contrast, contribute to unity and variety in a work.

Further study of textural patterns in music for other media, now in current organ repertoire, could contribute to a better understanding of the uses of textures in organ music.

281 pages. $3.65. Mic 58-4367

THE SONG CHOICES OF CHILDREN IN THE ELEMENTARY SCHOOL

(Publication No. 25,196)

Dorothea May Blyler, Ed.D.
University of Illinois, 1957

The problem of this study was to analyze the songs children like and do not like to sing. Nine thousand seven children in Illinois, Iowa, Kentucky, Michigan, Minnesota, Missouri, Ohio, Tennessee and Wisconsin participated. To make certain that they would have a common array of songs from which to choose, two widely accepted series of textbooks were chosen as a basis for the study—New Music Horizons and The American Singer. By means of questionnaires the children were asked to list their three favorite and three most disliked songs from the books and their three favorite songs learned outside of school. The songs were tabulated, analyzed and compared as to musical characteristics and poetic content. In explaining the musical preferences four hypotheses were proposed:

1. There are common musical factors present in the songs that children prefer to sing.
2. There are common musical factors present in the songs that children dislike to sing.
3. The song choices are influenced by the words of the

songs which correspond to the known interests of children of different levels of maturation.

4. Boys' choices are different from those of girls.

The results of the study indicated that the belief that children were automatically and irresistably attracted to folk music is erroneous. Left to their own devices their choices were well balanced between folk and composed songs. The words of the songs strongly influenced their choices. In general, the primary children liked lullabies, songs about birds and animals, fanciful characters and situations. Children in the fourth grade preferred patriotic music, nonsense songs and cowboys. Service songs were added to patriotic music in the fifth grade and the humor became more subtle. In the sixth grade cowboy songs were replaced by those of love land romance. Religious songs were present throughout the grades with the sixth grade children showing the greatest interest. The type of music the children learned outside of school and liked to sing was remarkably similar for all grades. Jazz topped the list and was followed by religious music. In general, boys and girls liked or disliked the same songs. They agreed on the first one or two pieces in each category but aside from these there was little agreement in the preference or rejection rank of the others. On the whole, the girls gravitated toward the more lyric poems and the boys toward the more vigorous ones. The songs the children preferred to sing had words in keeping with the known interest of their age group. Important as the poem was, the children were well aware of the music and preferred the more musically expressive songs. The melodies of these were interesting, the dynamic possibilities greater, the harmonic background were more varied than those of the rejected songs. The study should be of interest to teachers and supervisors or music and act as a guide in the planning of programs of study.

The study should be of value to those who work with children in musical situations, to those who compile works for their use, and to those who plan the musical curriculum of the school. 359 pages. $4.60. Mic 58-4368

LATIN SACRED MUSIC OF PETER PHILIPS (VOLUMES I-III)

(Publication No. 24,790)

Peguy S. Lyder, Ph.D.
New York University, 1955

Adviser: Gustave Reese

Peter Philips (c. 1560-post 1633), an English musician who served at Brussels as organist of the Archduke Albert of Austria and the Archduchess Isabella, is a representative composer between two eras.

The chief sources of information concerning his life are the documentary records of the Spanish court at Brussels and Philips' works, which are many and varied.

The first of a comparatively long list of collections devoted solely to him appeared at Antwerp in 1596. This is a Phalese publication of a set of madrigals for six voices. In 1612 we find the first published collection of his religious compositions; the last appeared in 1633.

Philips' earliest sacred polyphonic works consist of two sets of Cantiones sacrae. The first, published in 1612, is a set of five-voice motets for the principal feasts of the year and the common of the saints. Thirteen of these motets are preserved also in the Sambrooke MS. The second set appeared in the following year, and consists of thirty eight-voice motets. In the 1617 edition of the five-part compositions and a 1625 edition of the eight-part compositions, the composer added a part for basso continuo.

The collections that were published between 1616 and 1633 consist of pieces for one, two, and three voices with basso continuo, and a set of Litanies to the Blessed Virgin, also with basso continuo.

The material that is presented consists of a volume of transcriptions into modern notation of the 1612 Cantiones sacrae (sixty-seven motets for five voices); a volume of similar transcriptions of the 1613 Cantiones sacrae (thirty motets for eight voices); and a volume of commentary and stylistic analysis, in which are included thirty-five various music examples taken from Philips' Deliciae sacrae (1622), Paradisus sacris (1628, 1633), and Les Rossingnols spirituels (1616).

Examination of these pieces which total two hundred and fifty, indicates that this composer is a seventeenth-century exponent of the great polyphonic era, drawing that period to a close with compositions of real merit. At the same time, his later publications show him following the styles and practices of the Baroque era. The works which fall within this classification are interesting examples of Catholic church music of their period.

1613 pages. $20.25. Mic 58-4369

THE SUITE IN RELATION TO BAROQUE STYLE

(Publication No. 24,880)

Mildred Pearl, Ph.D.
New York University, 1957

Adviser: Professor Gustave Reese

This paper is a study of the suite in relation to Baroque style, attempting to determine whether this form properly belongs to the Baroque or is a Renaissance form, as has often been claimed. It is also an investigation of the evolving conceptions of the form, of the principles governing its organization at various periods, and of the roles played by the different nations of Europe in its crystallization.

The results of our study show that none of the sixteenth-century examples possesses the requisite qualities of a true suite and that, in fact, the suite coincides with the greater Baroque, roughly 1600 to 1750.

The sixteenth century did contribute to the suite the idea of a series and the emancipation of the musical dance forms from actual dance music. Couples dances also helped prepare the ground by affirming many times over the affinity of two dances on the basis of contrast of time and tempo.

The earliest true suites are the compositions of three dances by the Englishman William Brade, whose name should undoubtedly replace that of Peuerl, hitherto accepted as the earliest composer of the so-called "variation suite." The principal English contribution at this period is the stylization of the pavane and the galliard, the

former as the serious, polyphonic piece, the latter in a lighter and more homophonic vein.

The variation suites of Peuerl and Schein increased the series to four and five dances, thematically closely united and arranged in the order of decreasing stylization.

Beginning with the lute dances at the opening of the century and later on in the clavecin works, the French were the leading contributors to the history of the suite in their refinement of the dances. But the larger form remained undeveloped in France. New reasons for the anthological rather than the unified character of the suite in France have been sought by the author in contemporary French attitudes, particularly in the conception of the honnête homme and in the anti-professional bias of French polite society.

Using French dance patterns and melodic refinements, the Germans stabilized the form into the allemande-courante-sarabandegigue series. They frequently unified their suites by use of a free paraphrase technique or with motto openings. We have found, in our investigation, the sporadic use of motivic unification in suites before Bach's; still more important, this study has also newly revealed the impressive and varied use of such means by Bach himself, particularly in the Partitas.

The complex opening dance of the early series was later supplanted by various types of non-dance instrumental pieces—preludes, sonatas, sinfonias, French overtures. In adopting these large introductory pieces, the suite shares the predilection of other Baroque art forms for the dramatic announcement and preparation of their main subject matter.

The dissolution of the form is due, in our opinion, not so much to the overweighting of the overture and the incursion of optical dances (the reasons usually given), as to the limitations of this form with regard to functional key relationships, a fact which renders it unsuitable for the expression of the new dramatic ideals of the eighteenth century. 336 pages. $4.30. Mic 58-4370

A REPORT ON MUSIC SUPERVISION IN THE ELEMENTARY SCHOOLS OF CHAMPAIGN, ILLINOIS, 1954-1957

(Publication No. 25,297)

Robert Earl Thomas, Ed.D.
University of Illinois, 1957

Rapidly increasing elementary school polulations are calling for greater numbers of classroom teachers. If more than token programs of music education are to be maintained, then there is a need for additional trained music personnel or a redefinition of the role of available music personnel. Furthermore, in view of the fact that older practices in music education supervision are not consistent with the current philosophy of the self-contained classroom, the role of the music specialist, of necessity, must be redefined. This study describes and evaluates the consultant program in music education in the self-contained classrooms of the elementary schools of Champaign, Illinois. It describes the activities of the music consultant which were a part of the organization of the program, the program in operation, and the evaluation of the program.

To provide a more democratic supervision and a more unified and broader educational program for children, teachers, administrators, and the consultant worked and planned together in a variety of group settings.

The following means were employed to determine how well the objectives of the co-worker consultancy were fulfilled:

1. Anonymously written evaluations of the consultant program were obtained. These were analyzed for inferences of effectiveness.
2. An estimate of relative effectiveness was made by comparing records of teacher participation in previous and present music programs.
3. The attitude change of a school faculty as a result of faculty-principal-consultant planning was described and analyzed.
4. Case studies of individual teachers were made to (1) report attitude and change of attitude of teachers, (2) report musical growth of teachers through the use of consultative services, and (3) report teacher perception of the music program.
5. Comparisons of classroom visits among three groups of teachers were made to determine the extent of group participation in the program.

The findings of the study indicate that:

1. Teachers participate more freely in programs of supervision which they have helped to plan.
2. Teachers respond favorably to programs of supervision in which they receive consistent treatment from the consultative staff.
3. Teachers feel involvement and participate more readily in programs of creative supervision which place primary emphasis on teacher growth.
4. Teachers set more realistic goals for their performance in supervisory programs when their progress is constantly evaluated by both themselves and the consultant.
5. Teachers are self-critical of their performance in programs of supervision which they have helped to organize and put into practice.
6. Teachers participate more readily in a co-worker consultancy supervision than they do in an inspectional supervision.
7. Teachers feel more at ease in discussing teaching problems and in making suggestions for program improvement in their own faculty groups with their principals present.
8. Teachers involve themselves more readily in in-service education programs which are derived from their expressed needs and are followed by assistance in the classroom.
9. Teachers gain security, independence and satisfaction in classroom teaching through their participation in in-service education programs derived from their expressed needs.
10. Teachers are influenced to participate in programs of supervision by the participation of their colleagues.
11. Teachers who are involved in the planning and who feel that they can make a worthwhile contribution to democratic supervision tend to expand interest in various facets of the program.

190 pages. $2.50. Mic 58-4371

THE TURMMUSIK OF JOHANN PEZEL

(Publication No. 24,932)

James Albert Wattenbarger, Ph.D.
Northwestern University, 1957

Statement of the Problem.—This dissertation combines an analytical study of the Turmmusik[1] of Johann Pezel and an investigation of selected relative factors which would lead to clarification of the following: (not listed in order of importance)

(1) History and development of brass ensemble music;
(2) Significance and geographic limitations of the Turmmusik movement during the Baroque period;
(3) Differences in structure between Turmmusik and other music of the Baroque period;
(4) Other Baroque Turmmusik composers, and availability of their music;
(5) Accuracy of modern performances of Baroque brass ensemble music;
(6) Accuracy of modern editions of Baroque music;
(7) Life of Johann Pezel and his significance as a Turmmusik composer; and
(8) Present availability of the Turmmusik of Pezel.

Procedure.—The procedure of this investigation was to clarify the eight items given in the Statement of the Problem. The plan for presentation is:

(1) Factors responsible for the introduction of the Turmmusik movement;
(2) General survey of Turmmusik and its composers;
(3) Correct practices in modern performances of this music;
(4) Johann Pezel and his Turmmusik in particular; and
(5) Presentation in an appendix of the complete scores of the Turmmusik of Pezel available to the researcher.

Results and Conclusions.—In searching for an account of the life of Johann Pezel and his Turmmusik, inadequacies of source references were evident. Several of the sources were incomplete, and there was evidence that some statements were incorrect. Because of the more complete and better authenticated information given by Arnold Schering, one of the leading musicologists of the twentieth century, and incidentally one who evidenced a particular interest in the music history of Germany, his accounts are given special consideration in this investigation.

Pezel wrote two collections of Turmmusik: the Hora Decima (containing forty sonatas), and the Fünff-stimmigte blasende Musik (containing seventy-six pieces). These collections were included among the holdings of the Prussian Staatsbibliothek (now the Deutsche Staatsbibliothek) of Berlin before World War II. During the war all the major holdings of this library were distributed to various parts of Germany to escape damage by raiding Allied planes. At the time this investigation was made (1957), political conditions of Europe prevented the re-organization of these materials. Through correspondence with various libraries and publishers, it has been determined that a large part of the Hora Decima may never be recovered. A handwritten copy of the Fünff-stimmigte blasende Musik was made from the original before the war, and in all probability, will be published either separately or in groups from time to time, until eventually the complete collection will be available.

The complete scores to thirteen sonatas from the Hora Decima collection, and sixteen pieces from the Fünff-stimmigte blasende Musik collection appear in an appendix to this dissertation. 298 pages. $3.85. Mic 58-4372

1. A type of German seventeenth century functional music which was sounded on brass instruments from the tower of the town hall or a church at noon, sunset, as a time signal, and for various community activities.

PHARMACOLOGY

AN INVESTIGATION INTO THE CONTRACTION FAILURE INDUCED BY RYANODINE IN ISOLATED ATRIAL MYOCARDIUM AND INTESTINAL SMOOTH MUSCLE

(Publication No. 25,124)

Ira William Hillyard, Ph.D.
St. Louis University, 1957

Ryanodine, a purified alkaloid obtained from the South American plant, Ryania speciosa, Vahl (family, Flacourtiaceae) was found earlier to produce a specific, irreversible rigor of skeletal muscle, both in situ and in vitro which was dependent on muscle activity for initiation.

In isolated, spontaneously beating, kitten auricles, ryanodine induces a very specific depression of contractility in concentrations as low as 5×10^{-9} M. (2.5×10^{-9} gm./ml.). The failure is characterized by a rapid linear depression of the contractile height, which is completely irreversible to washing after initiation (one to two minutes). The velocity of the failure of contractility is proportional to the concentration used, but complete, irreversible failure occurs with all effective concentrations. The spontaneous rhythmicity of the auricles is depressed approximately five times less than contractility with all effective concentrations. After the ryanodine effect on contractility has been initiated, the auricles become refractory to further ryanodine treatment. However, pre-treatment with sub-threshold concentrations tends to sensitize the auricles to subsequent treatment with effective concentrations.

The contractility depression can be temporarily reversed by excess calcium and small doses of epinephrine and related substances. The magnitude of the initial antagonism is dependent on the concentration of ryanodine used. After the initial reversal the effectiveness of additional administrations is greatly reduced.

The contraction failure velocity is significantly dependent on the level of existing activity. The failure velocity is proportional to the environmental temperature. The velocity is also increased significantly by variations in the concentrations of calcium and potassium surrounding the muscle and by pre-treatment with acetylcholine,

glutathione, cysteine, ouabain and partial anoxia. Atropine pre-treatment decreases the failure velocity induced only when ryanodine concentrations are below 10^{-7} M.

In isolated rabbit duodenal smooth muscle, ryanodine produces a progressive increase in longitudinal muscle tonus. The threshold concentration approximates 10^{-7} M. (5×10^{-9} gm./ml.) in this preparation, with the degree and velocity of the effect dependent on the concentration employed. The "rigor" produced is completely irreversible to washing after its initiation, is not prevented by hexamethonium, but is temporarily reversed and prevented by epinephrine, papaverine and magnesium and relatively high doses of atropine, procyclidine and pyrilamine, with the effect recurring after removal of the antagonist.

The ryanodine effect on isolated duodenum is also dependent on the existing rhythmical activity. Agents such as dinitrophenol and cyanide and conditions such as high and low calcium and lowered environmental temperature markedly depress the rhythmical activity and significantly decrease both the velocity and magnitude of the rigor. Conversely, caffeine, which increases the existing activity, potentiates the effect.

Despite the apparent difference in the action of ryanodine on skeletal and intestinal smooth muscle and that produced on isolated cardiac muscle, there are two significant similarities in the effect on all three types: (1) the effect is markedly dependent on the degree of rhythmical activity present and (2) the effect is completely irreversible after its initiation.

The high specificity of ryanodine for all types of contractile tissue indicates that if the complete action of this alkaloid can be explained, it may be an extremely valuable aid to investigations into comparative physiology of contractility. 123 pages. $2.00. Mic 58-4373

ESTERS OF GENTISIC ACID AND THEIR TOXICITIES

(Publication No. 24,078)

J. Frank Nash, Ph.D.
The Ohio State University, 1952

Although salicylic acid and sodium salicylate have been used in the treatment of rheumatic conditions since 1876 and 1877, respectively,[1] salicylic acid's oxidation product, gentisic acid, remained unknown medicinally until September, 1948, when Meyer and Ragen reported the use of sodium gentisate for the relief of rheumatic symptoms.[2] Since then, numerous reports from the Western Hemisphere have substantiated the original belief of Meyer and Ragen.

The specific effect of salicylates upon the activity of hyaluronidase and salicylate action in rheumatic conditions dates back to the work of Guerra in 1946.[3,4]

Meyer and Ragen[2,5] claimed that the inhibition of hyaluronidase activity was due to the fact that salicylates are converted to gentisic acid, which acts as the true inhibitor. Salicylates are known to yield in the body from 4 to 8 per cent gentisic acid.[1,6,7]

However, Roseman et al.[8] showed pure analytical gentisic acid to be devoid of hyaluronidase inhibitory activity. Crude gentisic acid as well as pure gentisic acid treated with alkali in the presence of air did show activity. Therefore, it was concluded that the activity of gentisic acid was probably due to impurities in the product which had been formed by oxidation.

Another cause of rheumatoid arthritis has been thought to be hormone imbalance.[6] The salicylates may stimulate the adrenal cortex, causing liberation of corticoid substance. Adrenal cortical stimulation can be demonstrated in rats and guinea pigs by an increase in secretion of urinary 12 ketosteroids and a decrease in circulating eosinophils.[9]

Ginoulhiac and associates[10] have done extensive work on the toxicity and pharmacology of gentisic acid.

The work undertaken by the author was the production of new esters of gentisic acid. It was believed that by substituting a radical on gentisic acid which had medicinal action, new and better therapeutic agents for the treatment of rheumatism and the relief of pain may be produced.

EXPERIMENTAL

All melting points were obtained by using the melting point bath apparatus. The thermometer was calibrated over the temperature range of 50° to 285° by use of eight pure compounds. The corrected m.p. refers to correction for emergent stem.

Preparation, Analyses and Properties of New Gentisic Acid Esters.

Carboxylic Acid Ester Hydrochlorides

The carboxylic acid ester hydrochlorides of gentisic acid were prepared by the Horenstein and Pahliche procedure.[11] The process involves the condensation of a carboxylic acid and a chloralkamine either with or without a solvent. The best yield was generally obtained by dissolving the acid in isopropanol, adding the halide, and refluxing the mixture several hours. The hydrochloride generally precipitated when the solution was cooled. If the product remained in solution, the solvent was removed under vacuum and the mass treated with a solvent in which the salt was insoluble. The compound separated usually as a white solid. The compound was then recrystallized from a suitable solvent.

The dry method consisted of mixing the halide with an alcoholic solution of the carboxylic acid, removing the alcohol, and heating the residue 10 hours at 90° to 100°.

The mass was then extracted with a suitable solvent, i.e., acetone or ethyl acetate, to remove the unreacted materials. The insoluble salt of the amine was filtered. The compound was recrystallized from a suitable solvent.

The chloralkamines were obtained by the reaction of diethylaminoethanol or diethylaminoproponal with thionyl chloride. The reaction yielded the hydrochlorides. The salts were dissolved in cold water, the solution made strongly alkaline and extracted several times with ether. Upon removal of the solvent, the remainder was distilled to yield about 60 per cent of a colorless, strongly ammoniacal smelling liquid.[12,13]

The carboxylic acid ester hydrochlorides prepared, and their analyses, are listed in Table I.

Some physical and chemical properties of these esters are tabulated in Table II.

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Phenolic Esters

The phenolic esters of gentisic acid were prepared in best yield and greatest purity by the Schotten-Bauman reaction.[14] The procedure is as follows:

Equimolar portions of the phenol and acid chloride are reacted in 10 per cent sodium hydroxide. The phenol is dissolved in the alkaline solution and the acid chloride added with continuous stirring. The mixture is cooled slowly to room temperature and below this by aid of an ice bath. Cold dilute hydrochloric acid is added until the mixture is strongly acid. The precipitate is filtered and dried. The product can be purified by dissolving it in acetone or alcohol and reprecipitating by adding water. The process is repeated in the warm solvents to give greater purity. However, final purification should be brought about by recrystallization from a suitable solvent.

Table III lists the phenolic esters prepared and their analyses.

Table IV lists some of the physical and chemical properties of the esters.

Proof of Structure of New Gentisic Acid Esters by Analyses of Infrared Spectra.

The infrared spectra of the synthesized esters were analyzed by comparing them with the infrared spectra of known compounds,[15] and with the aid of infrared tables compiled by the Chemistry Department of the Ohio State University. The work of Randall et al.[16] was also consulted.

Carboxylic Acid Ester Hydrochlorides

The analyses of these spectra show the presence of one carbonyl function for diethylaminoethyl gentisate hydrochloride, diethylaminoethyl 5-methoxy-gentisate hydrochloride, and the diethylaminopropanol esters of the same nature. However, the diethylaminoethyl 5-acetyl-gentisate hydrochloride, diethylaminoethyl 5-benzoyl-gentisate hydrochloride, and the diethylaminopropanol ester counterparts show two carbonyl functions. The carbonyl functions indicate, in these cases, ester linkages.

Phenolic Esters

The analyses of these spectra show two carbonyl functions. The one carbonyl is produced by the ester linkage through the 5-hydroxyl of gentisic acid, and the other carbonyl represents the free carboxylic acid group of gentisic acid.

Toxicity of the New Gentisic Acid Esters.

The LD_{50} of the new gentisic acid esters was determined by intravenous injection into normal, healthy, white mice.

The LD_{50}'s for the carboxylic acid ester hydrochlorides and phenolic esters are listed in Table V.

SUMMARY

Attempts were made to synthesize several amino alcohol ester hydrochlorides or gentisic acid. From the attempt, eight new compounds were formed. The esters were prepared by the interaction of gentisic acid or 5-substituted gentisic acids and the chloroalkamine of diethylaminoethanol and diethylaminopropanol.

The five phenolic esters of gentisic acid were produced in good yield by the interaction of gentisic acid and the various acid chlorides. The 5-phenolic esters were produced because of the reactivity of the number 5 hydroxyl group of gentisic acid and the inertness of the number 2 hydroxyl group.

The site of esterification was proven by the aid of the ferric chloride color test, analyses of infrared spectra of the esters, and the neutral equivalents of the esters.

Doubt exists as to whether 5-acetylsalicyl-gentisic acid was actually produced. It is possible that hydrolysis before or after esterification may have yielded 5-salicyl-gentisic acid. The molecular weight, carbon and hydrogen, and infrared spectrum found for this compound can be explained if the compound was 5-salicyl-gentisic acid.

The increased toxicity of the carboxylic acid ester hydrochlorides over that of gentisic acid appears to be due primarily to the amino alcohol, but also partially to the group in number 5 hydroxyl position.

The increased toxicity of the phenolic esters appears to be due principally to the inherent toxicity of the substituted function on gentisic acid. However, the increased acidity of these compounds may be another reason for the increased toxicity.

It is believed that the principal reason the carboxylic acid ester hydrochlorides are more toxic than phenolic esters is the aqueous solubility of the former.

CONCLUSIONS

I. Thirteen new esters of gentisic acid were prepared, eight of which are carboxylic acid esters and five phenolic esters.

A. Carboxylic acid ester hydrochlorides.

(1) The esters were prepared in good yield by the interaction of gentisic acid or 5-substituted gentisic acids and chlorides of diethylaminoethanol and diethylaminopropanol.

(2) The compounds were analyzed for nitrogen and chlorine.

(3) Some physical and chemical properties of the compounds were determined.

(4) The neutral equivalents of the basic amine esters were determined.

(5) Diethylaminoethyl 5-acetyl-gentisate hydrochloride, diethylaminoethyl 5-benzoyl-gentisate hydrochloride, and diethylaminopropyl gentisate hydrochloride were analyzed for carbon and hydrogen.

B. Phenolic Esters.

(1) The esters were prepared by the interaction of the various acid chlorides and the number 5 hydroxyl group of gentisic acid in alkaline media, i.e. Schotten-Bauman reaction.

(2) Some physical and chemical properties of the compounds were determined.

(3) All the esters were analyzed for carbon and hydrogen.

(4) The neutral equivalents of the esters were determined.

II. The infrared spectra of the new esters of gentisic acid were analyzed to prove the structure of the compounds.

III. The LD_{50} of each new ester of gentisic acid was determined by intravenous injection of the compound into white mice.

122 pages. $2.00. Mic 58-4374

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Table I

Analyses of Synthesized Carboxylic Acid Ester Hydrochlorides

Name of Compound (Empirical Formula)	Molecular Weight in grams		Nitrogen Content in Per Cent		Chlorine Content in Per Cent		Carbon and Hydrogen Content in Per Cent	
	Calculated#	Found*	Calculated	Found*	Calculated	Found*	Calculated	Found
Diethylaminoethyl gentisate hydrochloride ($C_{13}H_{20}O_4NCl$)	253.30	252.11	4.84	4.68	12.58	12.61	----	----
Diethylaminoethyl 5-acetyl-gentisate hydrochloride ($C_{15}H_{22}O_5NCl$)	295.33	301.65	4.22	4.17	10.69	10.62	C, 54.30 H, 6.68	C, 54.41 6.78
Diethylaminoethyl 5-methoxy-gentisate hydrochloride ($C_{14}H_{22}O_4NCl$)	267.32	269.35	4.61	4.70	11.68	11.62	----	----
Diethylaminoethyl 5-benzoyl-gentisate hydrochloride ($C_{20}H_{24}O_4NCl$)	357.39	355.75	3.56	3.42	9.00	8.94	C, 60.85 H, 6.14	C, 60.40 H, 6.41
Diethylaminopropyl gentisate hydrochloride ($C_{14}H_{22}O_4NCl$)	267.32	265.50	4.61	4.65	11.68	11.80	C, 55.35 H, 7.30	C, 55.45 H, 7.42
Diethylaminopropyl 5-acetyl-gentisate hydrochloride ($C_{16}H_{24}O_5NCl$)	309.35	309.46	4.05	4.04	10.25	10.34	----	----
Diethylaminopropyl 5-methoxy-gentisate hydrochloride ($C_{15}H_{24}O_4NCl$)	281.34	280.17	4.41	4.35	11.16	11.27	----	----
Diethylaminopropyl 5-benzoyl-gentisate hydrochloride ($C_{21}H_{26}O_4NCl$)	373.42	366.84	3.43	3.60	8.69	8.62	----	----

*Average of two values.
#Calculated for free amine.

Table II

Properties of Synthesized Carboxylic Acid Ester Hydrochlorides

Name of Compound	m.p.*	Microscopic Appearance	Solubility					Stability#		Ferric# Chloride Test
			Water	Alcohol	Ether	Acetone	Chloroform	Solid	Solution	
Diethylaminoethyl gentisate hydrochloride	150-151°	Colorless Plates	s	s	i	i	i	+	-	+
Diethylaminoethyl 5-acetyl-gentisate hydrochloride	133.5-134.5°	Colorless Needles	s	s	sl s	sl s	s	+	-	+
Diethylaminoethyl 5-methoxy-gentisate hydrochloride	182.3-183.0°	Colorless Needles	s	s	sl s	i	s	+	-	+
Diethylaminoethyl 5-benzoyl-gentisate hydrochloride	153-154°	Colorless Needles	s	s	sl s	s	s	+	-	+
Diethylaminopropyl gentisate hydrochloride	171.5-172.5°	Colorless Plates	s	s	i	i	s	+	-	+
Diethylaminopropyl 5-acetyl-gentisate hydrochloride	157-157.5°	Colorless Needles	s	s	s	s	s	+	-	+
Diethylaminopropyl 5-methoxy-gentisate hydrochloride	184.5-185.3°	Colorless Needles	s	s	i	sl s	s	+	-	+
Diethylaminopropyl 5-benzoyl-gentisate hydrochloride	142.7-143.7°	Colorless Needles	s	s	i	s	s	+	-	+

*Uncorrected.
#+ equals positive; - equals negative.

TABLE III

Analyses of Synthesized Phenolic Esters

Name of Compound (Empirical Formula)	Molecular Weight in grams		Carbon and Hydrogen Content in Per Cent	
	Calculated	Found*	Calculated	Found
5-Phenylacetyl-gentisic acid ($C_{15}H_{12}O_5$)	272.25	273.38	C, 66.17 H, 4.44	C, 66.21 H, 4.51
5-Paranitrobenzoyl-gentisic acid ($C_{14}H_9O_7N$)	303.20	304.19	C, 55.46 H, 2.99	C, 55.43 H, 2.97
5-Anisyl-gentisic acid ($C_{15}H_{12}O_6$)	288.25	290.50	C, 62.50 H, 4.19	C, 62.43 H, 4.54
5-Acetylsalicyl# gentisic acid ($C_{16}H_{12}O_7$)	316.26	285.23	C, 60.76 H, 3.83	C, 61.63* H, 3.89*
5,5'-Succinyl-gentisic acid ($C_{18}H_{12}O_7$)	390.29	388.37	C, 55.39 H, 3.62	C, 55.20 H, 3.82

*Average of two values.
#Doubtful formula

Table IV

Properties of Synthesized Phenolic Esters

Name of Compound	m.p.*	Microscopic Appearance	Solubility					Stability#		Ferric Chloride Test#
			Water	Alcohol	Ether	Acetone	Chloroform	Solid	Solution	
5-Phenylacetyl-gentisic acid	145.5-146.5°	Colorless Fibres	i	s	s	s	s	+	-b†	+
5-Paranitrobenzoyl-gentisic acid	229-230.5°d.	Yellow Needles	i	sl s	s	s	i	+	-b†	+
5-Anisyl-gentisic acid	208.4 209.5°	Colorless Needles	i	s	s	s	s	+	-b†	+
5-Acetylsalicyl-gentisic acid	203.5-204.7°	Sheaves of Colorless Needles	i	s	s	s	i	+	-b†	+
5,5'-Succinyl-gentisic acid	230-231.5°d.	Colorless Fibres	i	s	sl s	s	i	+	-b†	+

*Uncorrected.
#+ equals positive; - equals negative.
†b equals basic.

TABLE V

LD_{50} of New Gentisic Acid Esters and Gentisic Acid

Name of Compound	LD_{50} in mg./Kg.
Diethylaminoethyl gentisate hydrochloride	51.2
Diethylaminoethyl 5-acetyl-gentisate hydrochloride	51.5
Diethylaminoethyl 5-methoxy-gentisate hydrochloride	32.2
Diethylaminoethyl 5-benzoyl-gentisate hydrochloride	41.7
Diethylaminopropyl gentisate hydrochloride	58.5
Diethylaminopropyl 5-acetyl-gentisate hydrochloride	44.5
Diethylaminopropyl 5-methoxy-gentisate hydrochloride	22.1
Diethylaminopropyl 5-benzoyl-gentisate hydrochloride	30.3
5-Phenylacetyl-gentisic acid	201.3
5-Paranitrobenzoyl-gentisic acid	83.5
5-Anisyl-gentisic acid	45.0
5-Acetylsalicyl-gentisic acid	32.4
5,5'-Succinyl-digentisic acid	155.0
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PHILOSOPHY

THE PROPER OBJECT OF METAPHYSICS IN THE LATIN TEXT OF AVERROES

(Publication No. 25,115)

Carl John Burlage, S.J., Ph.D.
St. Louis University, 1957

For Averroes, Metaphysics is distinguished from other speculative disciplines solely by the universality of its field: by the fact that, alone among the sciences, it deals with being as being—with the real and the properties of the real, understood in the "most universal" way. The exact significance of this "universality" characteristic of Metaphysics is determined by its nature as a strictly terminal science. Metaphysics can and does arise only as a result of the demonstrations of the Aristotelian Science of Nature in all its divisions.

The Metaphysician, then, can achieve a "more universal" understanding of being in two different, although closely related ways. First, he can provide a more extensive knowledge of the causes of things, by synthesizing the conclusions of various parts of preceding scientific investigation. This synthesis is impossible of achievement by the inferior sciences, because they lack "universality" of the second type, which involves an intensive and analytic appreciation of the fact that the causes hitherto known only in terms of their role as principles of the motion present in their effects can be perfectly and completely understood as causes of the whole being and reality of those effects.

What these causes are, it is not for Metaphysics to discover: it is ordered to the perfect understanding of the natures of the causal principles whose reality has already been established by the Science of Nature.

The investigation of these principles as "universal" causes of being is necessarily qualified by the meaning of being. It is an analogous term, subject first to the distinction between accident and substance, then to the further distinction between substance and cause of substance. It is this latter which most properly concerns the Metaphysician, so that his role becomes one of seeing that the substantiality and being proper to any given thing will be proportioned to its position in the hierarchy of causes of substance already established by the Science of Nature, and of drawing whatever conclusions he can from this state of things.

The Metaphysician, therefore, finds that being can be asserted more properly of the individual substance than of the accidents which are only its dispositions, and still more properly of whatever is principle of the individual's substantiality. These are, in ascending order, matter, specific forms-in-matter, Separate Forms—and to each of these last according to the extent of its causal influence, terminating in the First, who is substance absolutely, without any respect or relationship to anything else.

Here Metaphysics reaches its own absolute term: in knowing that the First Substance is absolutely substance, and that everything else of which being can be predicted is, and is what it is, simply because this First is what it is. The proper object of Metaphysics is the absolutely necessary and essential substantial character of everything that can be said to be. 363 pages. $4.65. Mic 58-4375

A CRITICAL STUDY OF THE VALUE AND ETHICAL THEORY OF C. I. LEWIS MADE BY REFERENCE TO CURRENT PSYCHOLOGICAL THEORIES OF PERCEPTION

(Publication No. 25,203)

Manuel Manson Davenport, Ph.D.
University of Illinois, 1957

As a prerequisite to critical analysis, the value-theory and ethics of Clarence Irving Lewis are presented. Following Lewis' suggestion that his own failure to resolve the basic ethical problem might be remedied by more knowledge concerning human nature and society, a general theory of perception—which considers the nature of immediate experience, self, and society—is presented. This general theory of perception is that of Floyd H. Allport; the theories of Bruner, Postman, Hebb, and others are considered also to supplement Allport's views.

Lewis' value and ethical theories are critically analyzed, in terms of both their internal adequacy and by reference to the general theory of perception. Such criticism reveals that Lewis' basis of the objectivity of value-judgments—immediate apprehensions of value-quality—must be rejected, and that Lewis has not provided a way of determining the rightness of actions. By means of reference to the general, or structural, theory of perception, a modification of the basic elements in Lewis' value-theory is attempted. As Lewis' treatments of immediate experience, self, and society are so modified, it is found that: (1) while Lewis' basis of the objectivity of value-judgments must be rejected, the structural theory of perception provides no alternative; (2) if such a basis is otherwise provided, the structural theory of perception will allow an alleviation of the difficulties attending the making of value-judgments; and (3) the social obligation suggested by the structural

theory of perception will allow actions to be determined as right only if the effect of actions upon the good of society in the long run is ignored.

Finally, the significance of the attempted modification of Lewis' value and ethical theories for empirical value-theory in general is considered. It is concluded that theories of human nature and society, as provided by the physical and social sciences, contribute to empirical value-theory by providing extended views of the determinants of human value. However, these views can contribute to the clarification of human value and the determination of ethical principles only if the problems of determining the objectivity of value-judgments and the nature of the valuable are independently resolved.

350 pages. $4.50. Mic 58-4376

THOMAS REID'S THEORY OF EMPIRICAL EVIDENCE

(Publication No. 23,432)

Timothy John Duggan, Ph.D.
Brown University, 1957

Chapter I, Sensation. The distinction is made between sensation and perception. Sensation, unlike perception, has no object. The expressions "an appearance," "a way of appearing," and "a way of being appeared to" are introduced for "a sensation" and "sensing." Pain is the model of sensation in general. The usefulness and liabilities of this model are discussed. Sensation has these characteristics: (1) it is essential to a sensation to be felt, (2) sensations have those and only those characteristics that they are felt to have, (3) sensation is a "natural principle" of belief, (4) we notice sensations only under unusual circumstances. I suggest ways in which Reid might have defended these four points.

Chapter II, Noticing. The conditions under which we can say of a man that he notices an appearance include (essentially) belief. A definition is given of "not-noticing." The truth conditions of a noticing sentence are: S has some belief at T about the way f in which he is appeared to (at T) which he would not have were he not thus appeared to (at T). The differences between noticing a physical object and noticing an appearance are described. Verbal as opposed to factual mistakes are discussed. Sentences (or beliefs) about appearances are privileged.

Chapter III, Privileged Utterances. I say which sentences (or beliefs) about appearances are privileged and in what way. The kind of mistake that one can make about appearances, and Malcolm's definition of "privileged" are discussed. The objections to the transition from "X appears f to S" to "S is appeared to f by X" are considered. The claim that all descriptive predicates are essentially comparative is discussed with reference to the non-comparative sense of "appears so-and-so." Only when words are taken in their non-comparative sense are sentences about appearances privileged. The argument to show that noticing is a condition of appearing is rejected.

Chapter IV, Perceiving. (1) The Phenomenological Sense of "Perceive." Reid uses "perceive" in two senses. In the phenomenological sense "S perceives X" does not entail "X exists." In this sense if S perceives X, then (1) S is appeared to, (2) X has a conception of X and an (immediate) belief in its existence, (3) S believes that the appearance he senses is caused by X, and (4) S has good evidence for the beliefs in (2) and (3). The word "take" is substituted for "perceive" in this sense. The concept of ostensible objects is criticized; and Reid is defended (using the concepts of taking and noticing) against the charge that he requires such a concept. Beliefs about takings are privileged in the same sense as beliefs about appearances.

Chapter V, Perceiving. (2) The Objective Sense of "Perceive." In this sense, if S perceives that X is f, then (1) S takes X to be f, (2) there is an X which is f, and (3) X sensibly stimulates S. The distinction between a perceptual claim (first person use of "perceive") and the endorsement of that claim (third person use of "perceive") is discussed. Seeing as is discussed. It is argued that suggestion is the converse of taking. I discuss public and private objects. Various senses of Reid's terms "original perception" and "acquired perception" are examined. Reid's claim that there can be no error in original perception is rejected.

Chapter VI, Reid's Critique of Skepticism. A modern version of the skeptical argument against our knowledge of the "external world" is described. Ayer's attempt to meet this argument (using "the method of descriptive analysis") is rejected. Reid's reply consists in (1) the denial of the skeptic's first premise, viz., in perception we are immediately aware of ideas only (of ways of being appeared to), and (2) his positive account of empirical evidence. Reid's reply together with his description of the "sources of evidence" and his doctrine of "first principles of contingent truth" is defended. Essentially, Reid's position is defended by arguing that alternative views "lead to the coal pit."

194 pages. $2.55. Mic 58-4377

INTERVAL MEASUREMENT OF SUBJECTIVE MAGNITUDES WITH SUBLIMINAL DIFFERENCES

(Publication No. 23,198)

Muriel Wood Winet Gerlach, Ph.D.
Stanford University, 1957

Subjective magnitudes, (such as felt weight or perceived tone) are distinguished from physical magnitudes, (such as objective weight, or acoustical frequency), through being discriminated by the sensory responses of living observers, rather than by physical operations using physical instruments. Are subjective responses capable of yielding quantitative orders?

Experimental efforts and theoretical formulations designed to establish subjective measurement are non-demonstrative. Classical psychophysical procedures make use of an underlying physical continuum, and do not achieve independent measurement of subjective magnitudes. Recent experimental attempts to construct sensory scales reveal inadequate understanding of the logical requirements for measurement. It has been incorrectly assumed that only extensive quantities are measurable, and hence that subjective measurement requires an operation for sensory addition. A more general defect is confusion as to the conditions for interval measurement. Although formally adequate theories for such measurement have been developed, when these theories are given a sensory interpretation,

they contain assumptions which are unreasonable empirically. Notably contrary to experience is the assumption that indifference, (psychological indistinguishability), is transitive, since it rules out subliminal differences.

This dissertation presents in axiomatic form a theory which aims at empirical plausibility and explicitly formulates sufficient formal conditions for interval measurement with subliminal differences.

The axiomatization makes use of two primitive notions, a non-empty set K, and a quaternary relation L whose field is included in K. In intended empirical interpretation, K is a set of physical stimuli; and x, yLz, w holds whenever the (subjective) sense distance between x and y seems algebraically less than the sense distance between z and w. A chain of defined notions is presented, intended to represent a possible route from the crude qualitative comparison of noticeably distinct sense distances, (characterized by L), to further apparent relations between sense distances or stimuli (such as indistinguishability of sense distances or stimuli), and from these to the inferred semi-quantitative relations which actually obtain between intervals and elements (such as genuine positional identity of elements, or exact ratio relationships between intervals). Using the defined notions, fifteen axioms on K and L are presented, which are intuitively appropriate to subjective measurement in the following respects: prior measurement of elements of K is not required; no operation corresponding to addition of elements is assumed; the axioms are compatible with the existence of an upper or a lower threshold of discrimination; and indistinguishability is not assumed transitive. The formal adequacy of the axiomatization is proved in a representation theorem. It states, in effect, that the axioms are sufficient to guarantee for any couple $<K,L>$ satisfying the axioms a numerical assignment to appropriate cosets of members of K with the following property: there is a positive real number Δ, such that the relation for cosets corresponding to L holds between two pairs of cosets if and only if either (i) the numbers assigned to the members of just one of the pairs differ by less than Δ, or (ii) the numbers assigned to the members of each pair differ by no less than Δ, and the difference between the two differences is no less than Δ. It is proved that such a numerical assignment is unique up to a linear transformation. Since intuitively Δ represents the size of the differential threshold or jnd, and a subjective magnitude may be interpreted as an equivalence class of physical stimuli, it is clear that the representation theorem guarantees the formal adequacy of the axiomatization to its intended purpose.

188 pages. $2.45. Mic 58-4378

PREDICATION AND REALITY IN PLATO

(Publication No. 25,125)

Reverend Leo Bernard Kaufmann, S.J., Ph.D.
St. Louis University, 1957

This dissertation, taking its clue from Aristotle on the ultimate subject of predication in Plato, investigates the movement of Plato's thought from an attempted dialectic of essences to a final dialectic of relations. It contends that if Plato's system is not wholly unified, in the more traditional neoplatonic interpretation, toward the middle dialogues, the later dialogues display an organon that is entirely compatible not only with Aristotle's criticism, but with Epistle VII, and the esoteric Lecture on the Good.

The early dialogues reveal Socrates and/or Plato entering on a scene in which the sophists, using now the relativism of Heraclitus and now the monism of Parmenides, had destroyed philosophical discourse. While Parmenides' discovery of Being had been the ultimate in the isolation and unification of the real, it choked off the area of scientific predication. But the early dialogues, with their predominantly ethical interests, sought to establish that, e.g. justice is different from injustice. This they tried to do through an unsuccessful search for essential meaning or definition.

However, with universal discourse still a given, the middle dialogues propose first a hypothetical approach which, though also failing to attain essential meaning, sets up the limiting conditions of the problem. Then Plato offers his golden dream of a dialectic of essences through a knowledge of the Good. It was to be an unhypothesized beginning that would found all predicational knowledge. Thus through reminiscence, absolute ideas, and the Good as the essence of all things, essential meaning would be established and the sophist refuted. This optimistic plan is never delineated in detail, and it remains the "hymn of dialectic" rather than dialectic itself.

Propositional knowledge was not saved for several reasons: 1. Such an answer to the relativism of Heraclitus was no solution to Parmenides' problem of error and negation. 2. The world of opinion would be subsumed into the world of science. 3. There can be no discourse without participation among the ideas themselves.

Plato himself acknowledges all these difficulties. Thus in the Theaetetus he shows that knowledge can never be distilled out of opinion. In the Parmenides he takes issue with his own original ideas which, as simple indivisible units, can never enter into predication. Moreover, he penetrates Parmenides' own position to show that nothing can be said of the One simply while everything indiscriminately must be said of the One Being.

Finally the Sophist establishes the Being of significant discourse but only at the price of parricide and the bold assertion of the reality and existence of non-being. Only by ferreting out and accepting the non-being that caused all the confusion with the One Being, can the One simply be applied to produce this Being of significant discourse.

But the ultimate condition of universal discourse is a scepticism of essences in which the forms, though not absorbed into their relationships, become intelligible only in relation and thus approach the primitive mathematical sequence which Aristotle calls form-numbers.

224 pages. $2.90. Mic 58-4379

A CONCEPTION OF THE PUBLIC

(Publication No. 25,150)

Robert D. Newton, Ph.D.
Columbia University, 1957

The term "public" has seldom been subjected to philosophical scrutiny and analysis. When it has, the treatment

has been excessively vague and largely dependent upon other conceptions developed to serve other functions. The frequency with which the term is employed and the difficulty of substituting related conceptions for it provide sufficient justification for attempting to define it more clearly. An examination of several historically important political theories leads to the conclusion that the development of a conception of "the public" depends upon a clarification of related conceptions like "association" and "community." If such a clarification is accompanied by an elaboration and refinement of Dewey's "generic conception of a public," it is possible to define certain characteristic features of public processes and events.

When the peculiarly public dimensions of a situation cannote be dealt with in terms of conceptions which are specifically coordinate with them, very general terms like "The People" or "The Public" may be employed, inadequately defined conceptions of "the public interest" or "public opinion" may be invoked, or existing conceptions of the state, community, association, or government may be extended beyond their proper functions. By systematically taking into account those who are affected, aware of being affected, interested, and active, a conception of the public is developed which is able to account for classes or groups that are generated by particular effects or issues. We then see that "a public," being a particular kind of configuration of individuals and groups, differs generically from an "association" or a "community." What is needed is a schema which will formalize the public dimensions of a situation and enable us to relate to the specific situation those who are involved in its public dimensions. By getting beyond particular groups and events to the usually very elusive public dimensions of a situation, we can see that what are referred to as "publics" are ordinarily rather transitory classes or groups which crystallize around an issue or similar focus if interest and usually dissolve when that issue is resolved.

When there are effects, issues, or controversies which are of family, community, or national dimensions, conceptions of the family, community, or nation are needed. The outcome of this study is that there are similar widespread and important effects, issues, or controversies which have public dimensions and require a conception which will be coordinate with them and consonant with the character of the resulting associations and activities. Though the resulting configurations may at times be coextensive in whole or in part with other kinds of associated groups like communities, the fact that they ordinarily do not coincide with the dimensions of such groups emphasizes the need for recognizing this other kind of related activity. An adequate conception of public activity must, moreover, be able to account for or explain the various uses of the term "public." When there are "public" dimensions in a situation, an adequate social philosophy should define these dimensions and provide a structure to which "publics" and "public activity" can be related.

87 pages. $2.00. Mic 58-4380

THE RATIONALIST MORAL ARGUMENT OF RICHARD PRICE

(Publication No. 24,879)

Leon Pearl, Ph.D.
New York University, 1957

Adviser: Professor Paul Edwards

This dissertation is a critical analysis of an argument by the eighteenth century English philosopher, Richard Price, for a rationalist position in morals. The dissertation is divided into three parts corresponding to the three divisions of Price's argument. In the first part I examine Price's argument for the simplicity of moral terms and the autonomy of moral discourse. The argument Price used is referred to in our own time as "The Naturalistic Fallacy." I try to show that Price did not prove that at least one moral term must be descriptively simple. I subsequently present my own interpretation of the "Naturalistic Fallacy."

In the second part, I examine Price's attempt to eliminate an objection to ethical intuitionism. The objection is that of the epistomological position of empiricist philosophy, namely that there are neither a priori concepts nor non trivial a priori judgments, I try to show that Price failed in his epistomological venture. In the following chapter, I attempt to prove that we can never know whether someone possesses or lacks a moral faculty of intuition. I invent a hypothetical figure who lacks a moral faculty of intuition. I then proceed to indicate why in principle it is impossible to detect the fact that he lacks this faculty.

In the third part I examine a series of arguments that Price used to refute the moral philosophy of Hutcheson and Hume. I stress those aspects of the arguments which are relevant to contemporary ethical theories. I try to show the inadequacy of the characterization, made by some present day emotivists, of the normative feature of a moral judgment as an expression of feeling. In this same section I deal with the difficulties a father would face in teaching his son that the terms "good," and "right," refer to non natural properties. I consider some methods which an ingenious rationalist father would use in an attempt to get his lesson across. I show, however, that his attempt will be in vain.

Throughout the dissertation I consider the rationalist position as a metamoral theory. In the concluding chapter I view it as a linguistic recommendation and as an expression of an ethical attitude.

228 pages. $2.95. Mic 58-4381

AUGUSTINIAN CITATIONS IN ST. BONAVENTURE'S FORMAL TREATMENT OF KNOWLEDGE

(Publication No. 25,137)

Sister Mary Monica Schneider, C.S.J., Ph.D.
St. Louis University, 1957

This study has illustrated the uses to which Saint Bonaventure has put the texts from Saint Augustine and has attempted to show within Bonaventure's discussions of human knowledge the nature and extent of his dependence upon Saint Augustine and his departures from him. No

attempt was made to deal with the many other influences affecting Bonaventure's thought. The Commentary on the Sentences was used for the study because it is representative of the works of Bonaventure and contains a plenitude of Augustinian citations.

In the schematic survey accomplished in Chapter Six evidence was brought forward to show that from the point of view of technique, Bonaventure does things that Augustine never considered. Stylistic differences are prominent and Bonaventure shows a genius for division. There is fairly free adaptation and a rich diversification of Augustinian doctrine revealed and suggested by the comparative study of texts.

In Chapter Two the matter that is relevant to sense knowledge and its physical conditions is treated. Chapter Three offers a treatment of intellectual knowledge in which the emphasis is on man's natural capacities for knowledge. In Chapter Four the Augustinian doctrine on mens is used as a point of departure in Bonaventure's treatment of certain knowledge. Here is considered the soul's knowledge of itself and its knowledge of God. Chapter Five continues the study of certitudinal knowledge as it is elaborated within the exemplaristic framework of Bonaventure. Foremost in this chapter is the doctrine on illumination and knowledge in the divine ideas.

Bonaventure accentuates Augustine's doctrine on light. He corroborates the teaching that the soul by means of light animates the body. He binds the soul more closely to matter than Augustine. Augustinian judgment shows marked similarities to the Aristotelian doctrine of abstraction as it is interpreted by Bonaventure. Bonaventure places more emphasis on the certitude of knowledge than Augustine does. He uses the doctrine of the soul as image of God consistently as the basis for the certain knowledge of truth. Throughout Bonaventure's doctrine on illumination, as it has been studied in the framework of the Augustinian citations, there is evidence of a synthesis that is original to the Seraphic Doctor.

The evidence is against those authors who tend to characterize Bonaventure merely as a slavish follower of Augustine. This can be seen from his surprisingly free handling of the texts of Saint Augustine. The evidence is no less against those authors who overemphasize the Aristotelian character of Bonaventure's doctrine. In spirit and in over-all import, Saint Bonaventure remains an intelligent disciple and defender of Saint Augustine. With respect to the relative weight of Augustinian or of Aristotelian influence upon Saint Bonaventure much further work needs to be done. There remains still to be done much patient and arduous scrutiny of his sources. Above all else, this study makes clear that exclusive and uncritical reliance upon Saint Augustine was quite foreign to Bonaventure's mentality and method. 242 pages. $3.15. Mic 58-4382

PHYSICS

PHYSICS, GENERAL

THE EFFECT OF A BUFFER GAS ON THE OPTICAL ORIENTATION PROCESS IN SODIUM VAPOR

(Publication No. 24,140)

Peter L. Bender, Ph.D.
Princeton University, 1956

The effect of a buffer gas on the optical orientation process in sodium vapor is studied by observing the change in polarization of the scattered light when a disorieting magnetic field is applied. For low pressures the change in polarization increased linearly with the buffer gas pressure, corresponding to the sodium atoms spending a longer time in the illuminated region. For higher buffer gas pressures the change in polarization reaches a maximum and then decreases, corresponding to disorientation by collisions with the buffer gas while the sodium atom is still in the excited state after absorbing a photon becoming important. An increase in the change in polarization by a factor 25 is achieved by the use of a buffer gas. Argon and nitrogen are found to give very similar effects, while helium gives a smaller increase because of its light weight and consequent ineffectiveness in keeping sodium atoms in the region of illumination.

A theoretical treatment of the effect of collisions on the state of the excited sodium atom is carried out and an effective collision diameter of 9 Å is found for mixing of the 3P states. A density matrix treatment is used to describe the effect of the collisions on the optical orientation process. The diffusion process is considered and a quite general expression found for the distribution of times spent by a particle in a subregion of a given region before hitting the wall. With the corresponding probabilities of scattering different numbers of photons, it is then possible to calculate the polarization of the scattered light and the orientation achieved. The agreement with experimental results for the change in polarization is fairly good, considering the approximations that were made. On the basis of the theory it is found that an average value of $\bar{M}_I = .6$ over the region of observation was reached, corresponding to 40% of the maximum possible orientation. It was also found that with a fairly simple apparatus an average orientation of 20% to 30% over the whole volume should be possible using a buffer gas. This degree of orientation is sufficient for angular distribution experiments with radioactive nuclei. With a buffer gas it is also possible to produce large differences in level populations for microwave resonance experiments with a small amount of light.

159 pages. $2.10. Mic 58-4383

ELECTRON OPTICAL INVESTIGATIONS OF GLASSES

(Publication No. 25,114)

Paul James Bryant, Ph.D.
St. Louis University, 1957

The surface structure of soda-lime-silica glass was investigated by optical and electron optical methods.

For the optical observations the surfaces were photographed following (1) washing and cleaning, (2) hydrofluoric acid etch, (3) removal of small surface chips by gentle fracture of the surface, and (4) evaporation of thin Bi films upon them.

The surfaces examined by both optical and electron micrographs showed features different from the interior of the glass. Selective etching apparently took place when the surface was treated with hydrofluoric acid, since dendritic type structures within the glass were brought out. The removal of thin surface chips uncovered structures which bore some resemblance to the dendritic forms, however, the size and general character of these fractured structures indicates that they are not devitrified areas.

The Bi films appear to form epitaxial deposits upon devitrified areas of the glass substrate by migrating to and building upon such dendrites. Evidence that the dendritic structures are not due to deposition from or chemical action by the etchant was obtained from light micrographs, taken directly, of the untreated surfaces. Although the pictures of the untreated glass are not as clear as those employing Bi films, the size and shape of the structures observed establishes their dendritic nature; these appear as definite structures embedded in but partly protruding from the body of the glass. Electron diffraction patterns show definite crystalline structure thus verifying this assumption.

The atomic structure of various glasses (soda-lime-silica, Pyrex and Corning super-pure vitreous silica) was investigated by electron diffraction utilizing a modified rotating sector technique. This technique provides a good semi-empirical evaluation of the amount of molecular coherent scattering. Several empirical methods were devised by which these evaluations could be checked. Each method yielded approximately the same molecular coherent scattering.

From such empirically corrected data the following interatomic spacings were obtained, for Corning super-pure vitreous silica, assuming the Warren model for SiO_2: silicon-oxygen 1.6A, oxygen-oxygen 2.5A, silicon-silicon 3.2A, silicon-second oxygen 4.2A, and oxygen-second oxygen 4.6A. These results are in good agreement with electron diffraction data reported by Antal[1] and Kamogowa[2], also with neutron diffraction data reported by Weber et al.[3]. However, the present values are somewhat larger than the results of Mc Clurg[4] for silica glass.

97 pages. $2.00. Mic 58-4384

K X-RAY ABSORPTION STRUCTURE IN SINGLE CRYSTALS OF Ge AND OF A Ge-Si ALLOY

(Publication No. 25,054)

Jassim Mohammed El-Hussaini, Ph.D.
State College of Washington, 1957

An investigation was made of the K x-ray absorption spectrum of germanium. The germanium was in the form of a very thin single crystal absorber placed between the two crystals of a double crystal spectrometer with high resolving power. A Geiger counter was used as a means for intensity registration.

No structure has been observed in or on the long wave-length side of the main edge.

Measurements on the extended absorption structure of a single crystal of germanium were carried out to about three hundred electron volts on the short wave-length side of the main edge, with three different orientations of the absorbing crystal.

Measurements of the absorption structure of single crystals of pure germanium and of 7 per cent silicon in germanium were obtained for the main edge and out to about 60 electron volts on the short wave-length side of the edge.

The structure that was obtained for pure germanium was compared with earlier investigations in order to determine the cause of discrepancies in the published fine structure.

With the amount of polarization of x-rays achieved, there was a significant shift in the extended fine structure for the three different orientations of the single crystal of pure germanium. This work gives evidence for Kronig's hypothesis, and the region in which this theory is most applicable.

A comparison was made of the main edges of pure germanium and 7 per cent silicon in germanium and a shift in the main edge was observed. This shift was attributed to a change in the position of the conducting band of the alloy.

Another comparison was made for the fine structure of pure germanium and of its alloy to about 60 volts from the main edge. A shift in the minima of the structure of the alloy (which are the allowed energies according to Hayasi's hypothesis) was observed and is discussed.

Some qualitative correlation was obtained between the present work and the theory of the band structure of pure germanium and of its silicon alloy.

66 pages. $2.00. Mic 58-4385

ADIABATIC ROTATIONAL COOLING AND NUCLEAR MAGNETIC RESONANCE IN CERIUM MAGNESIUM NITRATE BELOW 1°K

(Publication No. 25,216)

Thomas Leo Estle, Ph.D.
University of Illinois, 1957

Cerium magnesium nitrate, $Ce_2Mg_3(NO_3)_{12}\cdot 24H_2O$, is a highly anisotropic paramagnetic salt. The magnetic anisotropy results from the effects of the crystalline electric field on the one 4-f electron of the cerous ion. The Zeeman energy splitting of the ground doublet is βgH, where g is derived from an axially symmetric tensor in this case. The g value, g_{11}, along the trigonal axis is much less than that, g_1 , in the plane perpendicular to the axis.

In the present experiments, a single crystal of cerium magnesium nitrate has been cooled below 1°K in a strong magnetic field by a partial demagnetization followed by an adiabatic rotation of the crystal from a high to a low g direction. Both ballistic adiabatic susceptibility measurements and determinations of the relative nuclear magnetic resonance absorption were used to obtain the temperature. The lowest temperatures obtained were about 5 millidegrees.

The ballistic susceptibility measurements were made by employing a measuring field which was normal both to the strong field and to the trigonal axis. This was accomplished by mounting the crystal with the trigonal axis horizontal so that it could assume any angle between 0^0 and 90^0 with respect to the strong field. The absolute temperature of the crystal could be determined from the ballistic deflections by using only saturation and local measuring field corrections to the Curie law dependence of the ionic susceptibility on temperature. The resultant expression relating T*, the magnetic temperature, to T is

$$T = (T^* + \Delta_m)\frac{\tanh x_{loc}}{x_{loc}},$$

where Δ_m is the empirically determined Curie-Weiss delta in the measuring direction and

$$x_{loc} \text{ is } \frac{\beta g H_{loc}}{2kT}.$$

The ballistic measurements indicated that the ratio $g_\perp / g_{11}$ is much larger than the previously reported value of $7\frac{1}{3}$. The present measurements indicate a ratio which is greater than 60 and hence a value of g_{11} less than 0.03. As a result of the small value of g_{11}, T is proportional to $\sin\theta$ to within about 5% or better for θ greater than $2\frac{1}{2}^0$, where θ is the angle between the magnetic field and the trigonal axis.

The experiments employing nuclear magnetic resonance measurements indicated that under favorable circumstances the relative absorption could be employed as a thermometer. About a 5% accuracy was obtained in the present experiments which were performed by observing the resonance at 10mc./sec. of the protons in the waters of hydration of the cerium magnesium nitrate crystal. There are many non-equivalent proton sites in the crystal. A structure to the absorption curve results because each non-equivalent site will experience in general a different static local field. The static local field is produced by the time average magnetic moment of the cerium ions. In the case of cerium magnesium nitrate, this structure was 150 gauss or less in width and not appreciably resolved. A narrow absorption line is an advantage for thermometry but a disadvantage from the point of view of obtaining structural information about the crystal. The structure of the resonance was narrow principally because no protons lay closer than about 5Å to a cerium ion. The chief difficulty encountered in using nuclear magnetic resonance absorption as a measure of the temperature was the temperature dependent variation of the value of the r-f field at a proton site at low temperatures. When only the shape contributions to the local r-f field are taken into account, the temperature ratios obtained by nuclear magnetic resonance are approximately in agreement with the ballistic susceptibility measurements.

166 pages. $2.20. Mic 58-4386

NEW TECHNIQUES IN THE LAMB SHIFT CALCULATION

(Publication No. 25,371)

Herbert Martin Fried, Ph.D.
Stanford University, 1957

The development of a new method for both a simple estimation and an exact calculation of the Lamb shift is accomplished by a scattering-type iteration of the relativistic bound-state electron propagator in powers of the Coulomb potential. Examination of the "zero- and one-potential" terms of this expansion indicates the presence of spurious terms which would yield level shift contributions of the order of $\alpha(\not{z}\alpha)^2 mc^2$ and $\alpha(\not{z}\alpha)^2 lu(\not{z}\alpha)mc^2$. The cancellation of these quantities, with corresponding terms from the "many-potential" contributions, is conveniently demonstrated by the introduction (based on the requirement of gauge invariance) of an auxiliary sequence of "zero- and one-potential" and "many-potential" terms which does not alter the value of the level shift. When added to the previous series of Coulomb propagator iterations, the effect of the auxiliary terms is to explicitly cancel all such $\alpha(\not{z}\alpha)^2 mc^2$ and $\alpha(\not{z}\alpha)^2 lu(\not{z}\alpha)mc^2$ dependence. It is found that the resulting "zero- and one-potential" contributions provide an order of magnitude determination of the Lamb shift.

All the $\alpha(\not{z}\alpha)^4 mc^2$ and $\alpha(\not{z}\alpha)^4 lu(\not{z}\alpha)mc^2$ contributions are obtained; this permits a rigorous justification of the dipole approximation, and independent calculation of the corresponding lowest order Lamb shift. An alternative method of evaluating the major portion of the "Bethe logarithm," by direct and simple integration, is presented and shown to yield approximately 98.5% of the Lamb shift for the 1S state of Hydrogen. 103 pages. $2.00. Mic 58-4387

THE AUTOIONIZATION OF THE BETA CENTER AND THE FINE STRUCTURE OF THE BETA BAND IN NaCl

(Publication No. 25,220)

Ronald Fuchs, Ph.D.
University of Illinois, 1957

The Beta band, which is an optical absorption peak on the tail of the fundamental absorption band in alkali halides, occurs in crystals containing F centers. There is experimental and theoretical evidence that the Beta band is caused by the creation of an exciton next to an F center. The Beta center, which is the name we give to an exciton next to an F center, is susceptible to autoionization, since less energy is needed to ionize the F center than to create the exciton. Therefore it is of interest to calculate the autoionization rate in order to determine if this process affects the width of the Beta band.

The Beta center is assumed to consist of two electrons bound to a negative ion vacancy and a hole localized on the twelve next nearest neighbor negative ions. The two electrons bound to the vacancy have identical spatial wave functions which are essentially spherically symmetric. A linear combination of Cl^- 3p atomic orbitals is used to describe the hole state. The dipole selection rule for the

optical transition requires that the hole state transform like a P function under rotations and reflections about the vacancy site.

The final state in the autoionization transition is a negative ion vacancy and an emitted electron in the conduction band. The coulomb interaction between the two electrons which jump to different states is the perturbation which causes the transition. The calculations are carried out for NaCl.

We find a transition rate which corresponds to a line width of about 0.015 ev, or only 10% of the typical width of the Beta band. This is a strong indication that in general the autoionization of the Beta center contributes little to the width of the Beta band.

Group theoretical considerations show that there are three non-degenerate hole functions which transform like a P function under rotations and reflections about the vacancy site. This implies that the Beta center has three energy levels. The spin orbit interaction associated with the hole function splits each of these levels into a j=1/2 and a j=3/2 level. The matrix elements of the total Hamiltonian between trial Beta center functions are two 3x3 matrices for j=1/2 and j=3/2, which yield the six energy eigenvalues when diagonalized.

An estimate of these eigenvalues in NaCl indicates that the two lowest states are 0.1 ev apart and that the other states are about 2 ev higher. The two lowest states are assumed to be associated with the usual Beta band, which should have a visible doublet structure. The absorption peaks associated with the four higher states are not observable since they are superimposed on the fundamental band. The fact that only a single peak is observed in bromides and iodides may be due to the large spin orbit interaction in these salts, which splits the two lowest states by 0.4 ev or more, implying that all the peaks except the lowest one are hidden behind the fundamental band.

The calculated oscillator strength of the lowest component of the Beta band is 0.12, which is too small by a factor of about 5. This error may be caused by approximations in the wave functions which are used.

71 pages. $2.00. Mic 58-4388

RECENT STUDIES IN THE SPECTRAL REGION FROM 40 TO 140 MICRONS

(Publication No. 23,694)

Richard Lowell Hansler, Ph.D.
The Ohio State University, 1952

An automatic recording grating spectrograph has been constructed, in part by the author, to make measurements in the wave length region from 40 to 140 microns (1 micron = 10^{-6} meter). This is part of the spectral region known as the far infrared. Radiation in this region was first isolated by Rubens and Wood[1] in 1910. Since that time, only limited studies have been made in the far infrared. The instrument herein described produces spectra which show that a resolving power[2] of about 200 is obtained throughout the operating range. The aperture of the system is about f/4.0.

As a source of long wave radiation a thorium-oxide coated platinum strip is used which is heated to about 1300° K. by a current of 100 amperes passing through it. Since no material is known to have properties which make it suitable for use as a prism in the long wave region, a grating is used to disperse the radiation. In grating spectrometers some provision must be made to remove radiation which appears in orders higher or lower than the radiation which is to be measured. This is especially true in a far infrared spectrometer, for the intensity of the higher order short wave radiation is thousands of times greater than the intensity of the long wave radiation.

Discrimination against the short wave radiation is provided by a compensated potassium bromide chopper, reststrahlen filters, crystal quartz, soot coated paraffin, and an echelette grating (used as a reflection filter) with line spacing slightly less than the shortest wave length radiation which is to be passed by the filter.[3]

The radiation is dispersed by an echelette grating with 180 lines per inch, and with a ruled area 7 by 9 inches. The region from 40 to 55 microns is observed in the second order. The remainder of the region is studied in the first order. Table I shows the filtering used in the various spectral regions.

TABLE I

Region (Microns)	Compensated KBr Chopper	Quartz Detector Window	Sooted Paraffin Filter	NaCl Reststrahlen	Grating Filter	KRS-5 Reststrahlen of 1 mm. of Quartz
40- 70	yes	yes	yes	yes	no	no
70-110	yes	yes	yes	no	yes	no
110-140	yes	yes	yes	no	yes	either

A Golay pneumatic detector is used to detect the long wave radiation. The receiver of this detector consists of a thin metal film. The unique characteristic of this receiver is that the amount of radiation it absorbs is independent of the wave length of the radiation.

The output of the Golay detector is amplified by a low noise amplifier, and after rectification and filtering is displayed on a strip chart potentiometer.

The entire instrument is enclosed in steel covers and may be evacuated to a pressure of about 0.1 mm. of Hg. This is necessary since the water vapor in the atmosphere absorbs most of the long wave radiation. Control of slit widths, grating position, filter combinations, etc., is accomplished by means of motors placed inside the covers and operated from the outside.

The calibration of the instrument was accomplished, using the well-known positions of the water vapor absorption lines as standards.

In obtaining the spectra of corrosive gases a cell with $\frac{1}{2}$ inch optical path is used to contain the gas. The cell has polyethylene windows 0.004 inch thick, which transmit about 90 per cent of the long wave radiation.

The spectra of hydrogen chloride, deuterium chloride, hydrogen bromide, hydrogen sulfide, and ammonia were obtained in the region from 40 to 140 microns. The tabulated results of the measurements on the diatomic molecules are shown in Table II. The calculated values are based on the constants given by Herzberg.[4]

The spectrum of hydrogen sulfide is shown in Figure 1. The calculated spectrum is shown below the observed spectrum. The energy levels as given by Crawford and Cross[5] were used to calculate the frequencies. The inadequacy of the theory to predict all the observed lines is due

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

TABLE II

J″	J′	Frequency in cm⁻¹ Observed	Frequency in cm⁻¹ Calculated	Difference
		HCl Rotation Lines		
3	4	83.32	83.38	-0.06
4	5	104.13	104.13	0.00
5	6	124.73	124.82	-0.09
6	7	145.37	145.43	-0.06
7	8	165.89	165.95	-0.06
8	9	186.23	186.37	-0.14
9	10	206.60	206.67	-0.07
10	11	226.86	226.85	0.01
		DCl Rotation Lines		
6	7	75.15	75.24	-0.09
7	8	85.90	85.92	-0.02
8	9	96.51	96.57	-0.06
9	10	107.14	107.19	-0.05
10	11	117.81	117.77	0.04
11	12	128.26	128.31	-0.05
12	13	138.80	138.81	-0.01
13	14	149.26	149.26	0.00
14	15	159.71	159.67	0.04
15	16	170.06	170.02	0.04
16	17	180.39	180.31	0.08
17	18	190.69	190.54	0.15
18	19	200.99	200.73	0.26
19	20	211.07	210.81	0.26
		HBr Rotation Lines		
4	5	83.34	83.41	-0.09
5	6	99.87	99.99	-0.12
6	7	116.48	116.54	-0.06
7	8	132.88	133.02	-0.14
8	9	149.30	149.44	-0.14
9	10	165.69	165.78	-0.09
10	11	181.78	182.03	-0.25
11	12	198.13	198.20	-0.07
12	13	214.03	214.27	-0.24
13	14	229.89	230.32	-0.34

to the failure to include transitions between levels of high energy. The differences between the frequencies of the observed and calculated lines are probably due to errors in values of the centrifugal stretching constants used in computing the energy levels.

Eight of the pure rotation lines of ammonia are shown in Figure 2. The calculated spectrum based on the equation given by Foley and Randall,[6] a modification of the equation given by Slawsky and Dennison,[7] is shown below the observed spectrum.

Measurements of the far infrared transmission of the following solids were made: polyethylene, monochlorotrifluoropolyethylene, crystal quartz, fused quartz, nylon, saran, kodapack, mylar, germanium, silicon, paraffin, and diamond. Polyethylene and nylon were found to be the most transparent (about 90 per cent).

105 pages. $2.00. Mic 58-4389

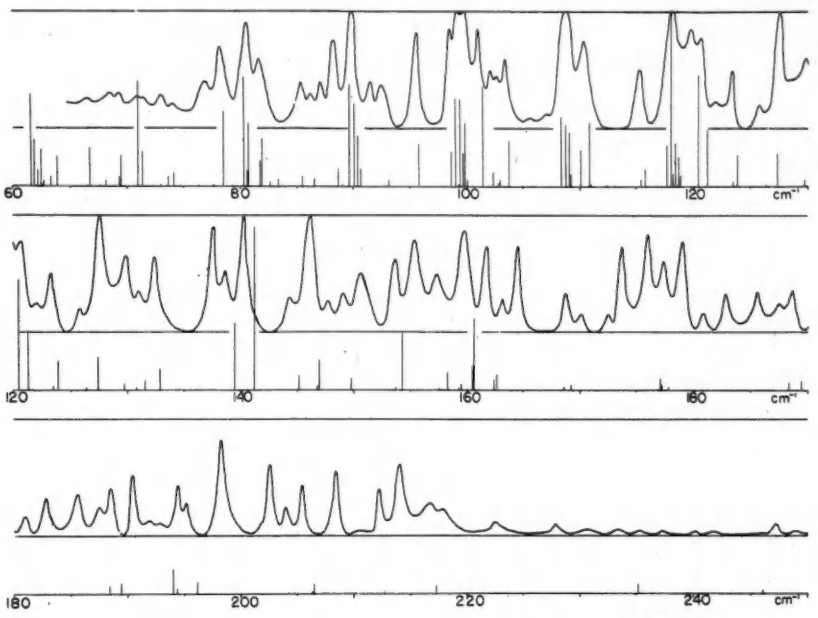
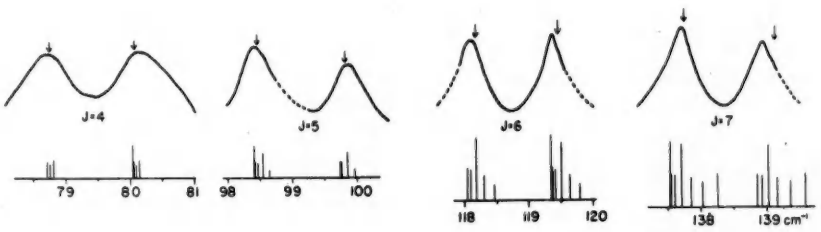


Figure 1. The far infrared spectrum of hydrogen sulfide. The observed spectrum is shown above; the calculated spectrum is shown below.



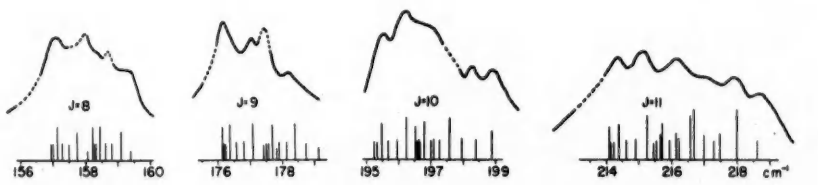


Figure 2. Eight of the pure rotation lines in the far infrared spectrum of ammonia. The fine structure results from the molecule becoming asymmetric for higher speeds of rotation. The arrows above the first four lines indicate the positions of the weighted averages of the calculated values. The doubling of the lines is the well-known inversion doubling arising because of the possibility of the nitrogen atom passing through the plane of the hydrogen atoms.

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Abstract published by special arrangement with The Ohio State University.

A STUDY OF THE FUNDAMENTAL VIBRATION-ROTATION BANDS IN THE INFRARED SPECTRA OF STIBENE AND DEUTERO-STIBENE

(Publication No. 24,497)

William Howard Haynie, Ph.D.
The Ohio State University, 1951

Introduction

The rotational details of the spectra of a symmetric top molecule have certain regularities which lend themselves rather readily to a determination of certain of the constants of the molecule. The tri-hydrides of the fifth group of elements in the periodic table are known to have the geometric form of a regular pyramid. They are classified as pyramidal XY_3 molecules and are among the simplest and most interesting examples of symmetric top molecules. The spectra of the first three members of this tri-hydride family, ammonia, phosphine, and arsine have been studied quite thoroughly. Previous spectroscopic work on stibene, the fourth member of this family, is described in papers by Smith[1] and by Loomis and Strandberg.[2] Smith's data were obtained with a prism instrument, and the accuracy of his results is limited by the inherently low resolution of a prism spectrometer. Loomis and Strandberg obtained microwave spectra of the hybrid molecule SbH_2D from which they were able to calculate the geometry of the molecule. The present investigation was undertaken to obtain more accurate measurements on the spectra of SbH_3 and SbD_3 under higher resolution, and to use these new data to determine as many of the constants of the molecule as the data would permit.

Experimental Work

Stibene is formed by the combination of nascent hydrogen with antimony. In this investigation the SbH_3 was generated by dropping a cold dilute (0.2N) mineral acid into an evacuated flask containing lathe turnings of 20 per cent Sb-80 per cent Zn alloy. The gas, containing about 2.5 per cent stibene in hydrogen, was passed through a calcium chloride drying tube into an evacuated absorption cell. Because of the small stibene yield, the reaction was allowed to continue until the pressure in the system reached about 740 mm. of mercury. The zinc-anitmony alloy was prepared with the aid of Professor Lord of the Department of Metallurgy. Antimony was added to molten zinc in a clay-graphite crucible, and the alloy was poured into a rod-shaped mold.

Deutero-stibene, SbD_3, was generated in essentially the same manner as SbH_3. "Heavy" sulfuric acid, D_2SO_4, was diluted to 0.2N with D_2O and dropped on lathe turnings of the zinc-antimony alloy. In order to minimize hydrogen contamination the generating apparatus was evacuated for 48 hours and flamed several times before starting the reaction. The available supply of D_2O necessary to dilute the D_2SO_4 was limited to 75 grams. To obtain maximum sample pressure with the resultant small quantity of dilute acid, the volume of the generating system was made as small as possible. By slowly increasing the acid concentration near the end of the reaction it was possible to obtain a pressure of about 650 mm. of mercury in a 15 cm. absorption cell.

Stibene is both toxic and chemically unstable, and should therefore be handled with care. It was found that in a thoroughly clean Pyrex cell fitted with well-polished salt windows, a sample could be used for about three days before the absorption bands became too weak to measure.

Each time a new sample of SbH_3 was generated, two cells, one 5 cm. long and one either 15 or 25 cm. long, were filled. The 5 cm. cell was used in the Beckman Model IR-3 prism spectrophotometer to map the vibration-rotation region of the spectrum and to record the strength of the sample. None of the samples generated in this investigation was strong enough to permit a measurement of any overtone or combination bands. The spectrophotometer records indicated that the two long-wave fundamental bands in the 11 to 14 micron region are only about one fourth as strong as the two short-wave fundamental bands lying in the 5 micron region. No prism records were run on SbD_3 because of the small quantity of this gas available.

To obtain records of the fine structure of the fundamental bands, the gas samples were run in the vacuum grating spectrograph described by Bell, Noble, and Nielsen.[3]

The short-wave fundamentals, ν_1 and ν_2, of SbH_3 and SbD_3 are shown in Figures 1 and 2 respectively. These

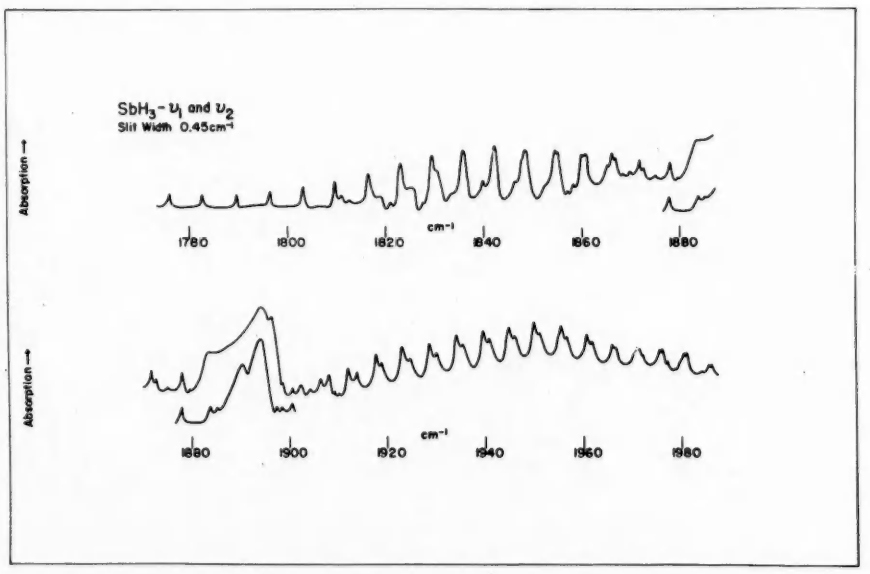


Figure 1.

two spectra were run with 15 cm. absorption cells, using a 3600 line per inch replica echelette grating. The double sets of lines near the centers of the two regions represent two sets of data run with different sample pressures. Qualitatively each of the two spectra shows two intense absorption maxima within 4 $cm.^{-1}$ of each other and essentially two strong sets of sharp lines on both sides of these maxima. The maximum having the lower frequency is assigned as the ν_1 (parallel) band center in each case, and the other maximum is then the center of the ν_2 (perpendicular) band.

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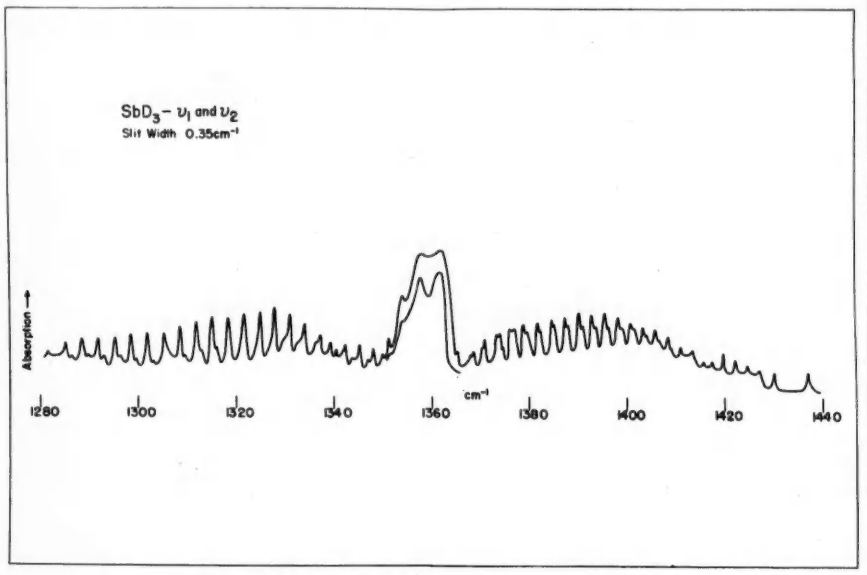


Figure 2.

It is apparent from the appearance of the two spectra that the sub-bands (one for each value of K = J) must be very nearly superposed. This indicates that both molecules approximate spherical tops in that the moment of inertia about the symmetry axis is very nearly equal to the other two principal moments of inertia.

Figure 3 shows the long-wave fundamental bands ν_3 and ν_4 of SbH_3. This spectrum was run with a 25 cm. absorption cell. The 3600 line/inch grating was used from 10.5 to about 12.5 microns, and from 12.5 to 14 microns an 1800 line per inch replica echelette grating was used.

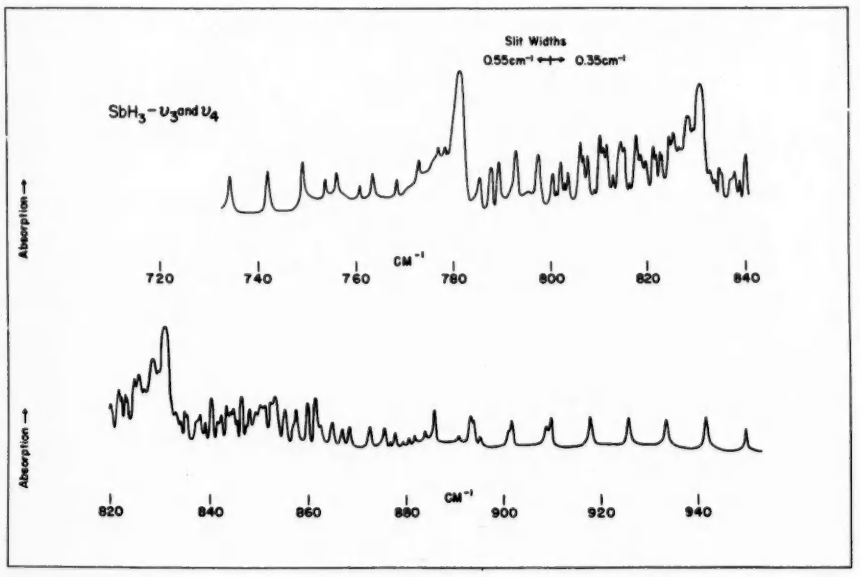


Figure 3.

The intense absorption maximum at 830 cm.$^{-1}$ is assigned as the ν_4 (perpendicular) band center, and the maximum at 781 cm.$^{-1}$ is identified as the ν_3 (parallel) band center. The complex appearance of this spectrum is due to a strong Coriolis interaction between these two fundamental vibrations.

The long-wave bands of SbD_3 lie in the 15 to 20 micron region. The SbD_3 samples were found to be too weak to permit measuring any structure other than the two band centers (ν_3 = 561.1 cm.$^{-1}$, ν_4 = 592.3 cm.$^{-1}$) and a few lines in the region of overlap between the two bands.

The greatest error in the frequencies of the absorption lines was introduced in locating the line centers. This error is estimated to be $\pm$ 0.1 cm.$^{-1}$, since in most cases the variation in frequency of a given line, determined from several different records, was within these limits. The frequencies used in calculating the molecular constants represent weighted averages of at least two, and in many cases five or six, independent measurements from as many separate records.

In the discussion to follow, quantities associated with the molecule SbD_3 will be identified with a superscript star, and quantities associated with SbH_3 will be unmarked. When well-known combination relations are applied to the sets of fine structure lines assigned to the parallel band ν_1, the following rotational constants are determined: B″ = 2.935 cm.$^{-1}$, B′-B″ = -0.031 cm.$^{-1}$, and ν_1 = 1890.9 cm.$^{-1}$; B*″ = 1.486 cm.$^{-1}$, B*′-B*″ = -0.011 cm.$^{-1}$ and ν_1^* = 1358.8 cm.$^{-1}$. From the rotational constants the moments of inertia about axes perpendicular to the symmetry axes are found to be: I''_B = 9.534 x 10^{-40} g. cm.^{2} and $I^{*''}_B$ = 19.635 x 10^{-40} g. cm^2.

The equilibrium value of the moment of inertia I_B may be written in terms of the atomic masses, the pyramid height, h and β, the angle between one of the XY bonds, and the axis of the top as

$$I^e_B = 3mh^2\left(\frac{1}{2}\tan^2\beta + \frac{M}{3m+M}\right) .$$

If it is assumed that the geometry of SbD_3 is the same as that of SbH_3 and that

$$\frac{I^e_B}{I^{*e}_B} = \frac{I''_B}{I^{*''}_B}$$

and the expression for I^e_B is divided by the corresponding expression for I^{*e}_B, the resulting equation may be solved for the pyramid apex angle in terms of the rotational constants B and B* and the atomic masses. It is found that in the case of stibene the angle β is very sensitive to the ratio of the B values, and therefore the angle calculated in this manner is in error by about $\pm$ 1°. The value of β calculated from the rotational constants is found to be $\beta = 54°40'$, which agrees satisfactorily with the value 55°48′ calculated from the microwave data of Loomis and Strandberg. Using this value of $\beta = 54°40'$, the pyramid height is found to be h = 0.98A. The moments of inertia about the symmetry axes are calculated from the relation: $I_C = 3mh^2\tan^2\beta$. They are found to have the values: I_C = 9.635 x 10^{-40} g. cm.^{2} and I^*_C = 19.255 x 10^{-40} g. cm.^{2} The corresponding rotational constants are: C = 2.905 cm.$^{-1}$ and C* = 1.435 cm.$^{-1}$.

The Teller parameters ζ_2 and ζ_4 are determined from the fine structure spacing in the perpendicular band ν_2 and have the values: ζ_2 = -0.015, ζ_4 = -0.480, ζ^*_2 = -0.017 and ζ^*_4 = -0.072.

Lechner,[4] assuming a valence-type force field, has developed a relation between the normal frequencies, the valence force constants, the atomic masses, and the cosine of the pyramid apex angle β. If this relation containing the constants of SbH_3 is divided by the corresponding relation for SbD_3, the result may be solved to obtain β in terms of the normal frequencies and the atomic masses. Dennison[5] has proposed a method for correcting the observed band centers to approximate the normal frequencies. This approximation is applicable to stibene, and has been used to determine the normal frequencies of the two perpendicular vibrations ω_2 and ω_4. These values are then substituted

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into Lechner's equation to obtain a check on the pyramid apex angle.

Since the value of β calculated from the rotational constants was somewhat indeterminate, all succeeding calculations which depend upon the value of β have been performed for three assumed values of β for both molecules. It is concluded that the most probable value of the pyramid apex angle is $\beta = 54.5^0$. The molecular constants presented in the preceding text were calculated from an angle $\beta = 54^040'$, and are therefore within the limit of error in the data and the calculations.

64 pages. $2.00. Mic 58-4390

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Abstract published by special arrangement with The Ohio State University.

NUCLEON IRRADIATION OF SILICON SEMICONDUCTORS

(Publication No. 25,408)

Thomas Anthony Longo, Ph.D.
Purdue University, 1957

Major Professor: Karl Lark-Horovitz

There is great interest in the effects of high energy nucleon irradiation on matter. In particular, the physical properties of semiconductors have been found to be very sensitive to the disorder introduced by energetic nucleon irradiation. However, most of the previous information had been obtained for germanium. Therefore, the object of this work was to investigate the effects of nucleon irradiation on the electrical and optical properties of silicon.

After fast neutron irradiation, the inverse temperature dependence of the logarithms of Hall coefficient and resistivity of both n-type and p-type single crystal silicon samples indicated that intrinsic behavior was approached in each sample. A 1.75μ peak in the optical absorption coefficient was observed. This peak is believed to result from optical excitation rather than ionization of an introduced defect level since it is not accompanied by an increase in photoconductivity. Appreciable photoconductivity was observed beyind the fundamental region to about 1.45 microns.

Annealing experiments were continued on a polycrystalline p-type silicon sample which had been previously irradiated with fast neutrons. After annealing at temperatures ranging from 150°C to 250°C, the slopes of the logarithms of Hall coefficient and resistivity vs. $10^3/T$ decreased, suggesting the rearrangement of introduced defect levels accompanying annealing. During annealing, the absorption peak at 1.75μ gradually disappeared and an absorption tail extending past 30μ increased.

Quantitative information was needed in order to establish the nature and numbers of the defects introduced by the irradiations. Therefore, n- and p-type silicon were irradiated with 9.6 Mev deuterons from the Purdue cyclotron. The Hall coefficient and conductivity of degenerate and non-degenerate samples were measured as a function of irradiation. The carrier concentrations of all samples were reduced by irradiation.

For n-type degenerate samples, the change in carrier concentration with flux $\frac{\Delta n}{\phi} = -670$ electrons cm^{-1} per deuteron and for p-type degenerate samples $\frac{\Delta p}{\phi} = 750$ holes cm^{-1} per deuteron. These compare favorably with a calculated rate of defect pair introduction $\frac{\Delta N}{\Delta \phi} = 775$ defect pairs cm^{-1} per deuteron, with one carrier removed per pair. This work supports the belief that the introduction of close vacancy interstitial pairs is the predominant effect of irradiation.

The changes of carrier concentration with flux decreased rapidly as the Fermi level moved into the forbidden band. The interstitial states appeared to be at 0.025 ev from conduction band and the vacancy states at 0.055 ev from the valence band.

For heavy irradiations, the removal rates were lower in the degenerate and higher in the non-degenerate regions than what was observed for smaller irradiations. This suggested clustering of defects and the states associated with these clusters appeared to be introduced deep in the forbidden gap.

93 pages. $2.00. Mic 58-4391

IN-FLIGHT ANNIHILATION OF POSITRONS

(Publication No. 25,335)

Samuel J. Raff, Ph.D.
University of Maryland, 1957

Supervisor: Dr. Roald K. Wangsness

The cross section for in-flight annihilation of positrons with electrons at rest has been measured at 300, 175 and 100 Kev position kinetic energy in lead and in aluminum. The method employs a beta spectrometer to focus positrons from Na22 on a foil and the annihilation is detected by the capture of both annihilation quanta in coincidence. All the measurements in aluminum, and the 300 Kev measurement in lead, agree with the theory to the accuracy of the experiment which is estimated at $\pm$ 6%.

At the lower positron energies in lead, the repulsion of the positrons by the nuclear field may be expected to reduce the observed annihilation rate. The magnitude of this effect is calculated to be 18% for the annihilation of 100 Kev positrons in lead. The observed counting rate indicates that the nuclear field reduces the annihilation rate by 40% under these conditions. For the 175 Kev positrons in lead, where the nuclear field repulsion effect should be very

small, the observed annihilation rate is 25% less than the calculated. These discrepancies occur in the region where the electron binding energies are comparable with the positron kinetic energy. Calculations indicate that the order of magnitude of the discrepancies is such as could be explained by taking into account the momentum of the bound electrons, the principal effect of which is to change the distribution of energy between the annihilation quanta.

75 pages. $2.00. Mic 58-4392

STATISTICAL FOUNDATIONS OF IRREVERSIBLE THERMODYNAMICS

(Publication No. 24,807)

Burt M. Rosenbaum, Ph.D.
Case Institute of Technology, 1957

This thesis reports an investigation by the methods of statistical mechanics of the basic theorems of irreversible thermodynamics: Onsager's reciprocal theorem and the principle of mininum entropy production.

The methods of Klein and Meijer are used first to gain insight into the microscopic nature of steady states which are near equilibrium states, and to determine the restrictions which must be imposed in order that macroscopic thermodynamic quantities can be introduced in nonequilibrium situations. The two theorems mentioned are derived for one-dimensional models by these methods.

A general theorem for isolated systems is then established concerning the ratio of the probability of occurence of any particular microscopic transition to the corresponding probability for the inverse transition. The theorem expresses this ratio in terms of the entropy change associated with the transition. This theorem is used to give a general discussion of one-dimensional irreversible coupled flows in the absence of external magnetic fields.

The methods employed permit one to obtain a clear physical picture of the meaning of all terms introduced, and therefore lead to a clarification of the assumptions underlying irreversible thermodynamics.

89 pages. $2.00. Mic 58-4393

THE MUTUAL REFLECTION OF TWO SHOCK WAVES OF ARBITRARY STRENGTHS

(Publication No. 23,872)

Wesley R. Smith, Ph.D.
Princeton University, 1957

The interaction of two weak shock waves of equal strength $\xi = 0.915$ was studied experimentally. The weak solution of the two-shock theory agreed with the regular reflection data, but the three-shock theory did not agree with the Mach reflection data. The Mach reflection data showed that the differential dependence of χ on α predicted by a strictly local theory was incorrect.

Extensive data on the transition from regular to Mach reflection indicated that regular reflection terminates very near the extreme angle α_e and does not persist beyond it. This result is supported by previously unpublished data for the reflection of a strong shock from a wedge. An argument suggesting that regular reflection should stop at the sonic angle α_s could not be checked experimentally because of the very small angular separation between α_s and α_e.

A comparison of the data from the interaction of two equal shock waves with previous data from the reflection of a plane shock from a wedge showed these two physical situations are equivalent experimentally as well as theoretically.

The presence of the reflecting wedge probably obscured the transition between regular and Mach reflection in earlier experiments and led to the erroneous conclusion that regular reflection persisted beyond α_e.

Four sets of experiments on the interaction of two shock waves of unequal strengths were performed and the data compared with the results of graphical shock polar calculations made for each set. The weak regular reflection solutions agreed with the regular reflection data. No explicit calculations were made to compare with the Mach reflection data, for the data from three of the sets obviously could not agree with the three-shock theory. The strengths of the unequal interacting shocks were not great enough to produce Mach reflection configurations which would be expected to agree with the three-shock theory.

Although the data on the transition from regular to Mach reflection was not conclusive, it is not inconsistent with the conclusion that regular reflection does not persist beyond the extreme angle. A regular reflection calculation performed for one of the experimental sets indicated that a sufficiently large angular separation may exist between the sonic angles and the extreme angle to enable a future experiment to determine which of the angles is the limit of regular reflection. 155 pages. $2.05. Mic 58-4293

CLASSICAL THEORY OF TRANSPORT PHENOMENA IN DILUTE POLYATOMIC GASES

(Publication No. 24,930)

Norman Taxman, Ph.D.
Northwestern University, 1957

A classical theory of transport phenomena in dilute gases of molecules possessing internal degrees of freedom is presented, not assuming the existence of inverse collisions. Equilibrium and first-order non-equilibrium solutions of the Boltzmann equation are found which yield first approximations to the coefficients of thermal conductivity, shear viscosity and bulk viscosity. The results are expressed in collision parameter formulation in terms of the details of a classical scattering event between two molecules of the gas considered. In cases where the molecules make only elastic collisions, the expressions found reduce to the well-known Chapman-Enskog expressions for the transport coefficients. Our treatment is very similar to the semi-classical one of Wang Chang and Uhlenbeck, who have treated the internal degrees of freedom quantum-mechanically and could thus use the fact that quantum inverse collisions exist. The present theory gives the same results as theirs in the classical limit.

Next, a general theory of transport in gases for which

the variations in the internal degrees of freedom may be treated as classical perturbations on the predominant central-field behavior is given.

Finally, using the foregoing ideas, it is shown how high-temperature polar gas transport properties may be calculated. 85 pages. $2.00. Mic 58-4394

EXPANSION OF COPPER UPON LOW TEMPERATURE DEUTERON IRRADIATION

(Publication No. 25,302)

Richard Werner Vook, Ph.D.
University of Illinois, 1957

The increase in linear dimensions of a 99.999% copper foil upon deuteron irradiation was measured directly as a function of integrated flux. Two bombardments were made on the same specimen with integrated fluxes of 3.14×10^{16} d/cm^2 and 7.68×10^{16} d/cm^2 respectively. It was found in both runs that the specific change in length per incident deuteron per square centimeter was 3.8×10^{-21}. This value applies to an average deuteron energy of 8.5 mev.

Measurements of the thermal recovery of the irradiation-induced change in length were also made. If the thermal recovery between the bombardment temperature and room temperature are designated as Stage I ($< 70^\circ$K), Stage II (70-180°K), and Stage III (180-300°K), then the amount of recovery per stage is 64%, 6%, and 26% respectively. The residual effect remaining at 300°K is 4% of the maximum effect. It is suggested that the defects introduced by the deuteron irradiation are Frenkel pairs and that thermal recovery proceeds by means of a single atomic process between the bombardment temperature of 17°K and 300°K. 36 pages. $2.00. Mic 58-4395

PHYSICS, ELECTRONICS AND ELECTRICITY

ON THE EXCITATION OF SURFACE WAVES

(Publication No. 23,426)

William Shen Chie Chang, Ph.D.
Brown University, 1957

One of the major problems unsolved in the application of surface waves to microwave transmission lines and antennas is to find a practical efficient means of excitation. In this thesis, the theoretical research on the following five different ways of exciting the surface waves are presented in hopes of providing some guidance to the practical design of an efficient excitation device.

(a) A magnetic line is placed parallel to an infinite plane dielectric slab to excite its lowest T.M. surface wave.

(b) Similar to (a), a magnetic line is placed parallel to two identical separate parallel infinite dielectric slabs to excite their lowest T.M. surface wave.

(c) The same structure described in (b) is excited by a vertical electric dipole instead of a magnetic line.

(d) A grounded dielectric slab is extended into a parallel plate waveguide with their bottom conductors matched to each other. The lowest surface wave of the grounded slab is excited by the dominant T.M. mode of the partially filled parallel plate waveguide.

(e) Similar to (d), the lowest circular symmetric T.M. surface wave of a dielectric rod is excited by fitting this rod into a cylindrical waveguide. The input power is carried by the T.M.$_{01}$ mode of the cylindrical waveguide.

All these problems are the simplification of some practical known means of excitation in order to render them to be mathematically solvable. Cases (a), (b), and (c), are the idealization of either a slot or a finite dipole exciting such structures, while the parallel plate waveguide is more or less an idealization of a rectangular waveguide. Moreover, the solutions of problems, (a), (b), and (c), are also the Green's functions of the vector wave equation for such structures which would be very useful in predicting the asymptotic solutions of many other problems.

Mathematically, these problems are treated as boundary value problems. Since Maxwell's Equations are separable in here, they are solved by the special method of transformation called the Guided Wave Concept. This Guided Wave Concept consists essentially of eliminating the longitudinal components of the electromagnetic fields from Maxwell's Equations and replacing the resulting equations concerning the transverse components by a transverse eigen-value equation and a longitudinal transmission line equation. The transverse fields are represented by the summation of a convenient complete set of eigen-functions, which satisfy the eigen-value equation, times their modal amplitides which satisfy the transmission line equation.

In solving the problems (a), (b), and (c), the major mathematic task lies on the solution of the eigen-value problems by the Characteristic Green's Function Method. On the other hand, for problems (d) and (e), the major difficulty lies on the solution of the transmission line equation due to the semi-infinite boundary condition imposed by the walls of the waveguide. This difficulty is overcome by means of (1) applying the Wiener-Hopf Technique, and (2) analyzing the correlation between the asymptotic solution and the singularities of the transformed kernel of the integral equation of the semi-infinite boundary.

After the asymptotic solutions have been found, numerical computations are carried out for problems (a), (b), (c) and (d), for $\epsilon = 2.49$, for various dimensions of the source, for several normalized sizes of the structures. The radiation patterns, total radiation losses, and excitation efficiencies, are plotted versus the dimensions of the sources whenever it would be valuable. These results are then discussed in detail at the end of each problem and in the final summary evaluation to determine the practicality and preferness of the various means of excitations considered, and to study the effect of the location of the sources and the dimensions of the structures on the efficiency of excitation.

It is found that, although the maximum excitation efficiency of the dipole or the magnetic line is comparable to that of the parallel plate waveguide, their efficiency falls of rapidly when the dimensions do not have the proper values. It follows that the parallel plate waveguide is the

best of all the means of excitation calculated due to its low radiation loss and high over all efficiency. In general, for all the cases, the excitation efficiency would be higher if the slab is thick and the source is nearer to the center of the slab (or to use a larger parallel plate waveguide). It is always more efficient to excite a grounded slab than to excite a single isolated slab (to excite an isolated slab either symmetrically or antisymmetrically would have the same effect as grounding it).

208 pages. $2.70. Mic 58-4396

THE EQUIANGULAR SPIRAL ANTENNA

(Publication No. 25,214)

John Douglas Dyson, Ph.D.
University of Illinois, 1957

A new antenna is described which makes possible radiation pattern bandwidths previously considered to be impossible.

The design of the antenna is based upon the simple fundamental principle that if the shape of the antenna were such that it could be specified entirely by angles, its performance would be independent of wavelength.

Since all such shapes extend to infinity it is necessary to specify at least one length for an antenna of finite size. This principle can be used as a basis for practical antenna design, because in some cases the antenna performance is practically independent of wavelength provided this one length is very large compared with the wavelength of operation.

Each arm of the equiangular spiral antenna is defined by two identical equiangular spiral curves, one rotated through a fixed angle around the origin with respect to the other. Thus the antenna is completely described by two angles and one specified arm length. It is remarkable in that this one length need only be comparable to one wavelength to obtain operation essentially independent of frequency. It is the first antenna to exhibit, in a practical size, the characteristics associated with an infinite structure.

The investigation is concerned with the planar balanced antenna which radiates a broad lobe perpendicular to the plane of the antenna over a practical range of parameters. The radiation is bidirectional with equal beams radiated from the front and the back of the structure. The beam is circularly polarized on its axis, over the useable bandwidth. There is no basic tilt to the lobe of the symmetrical antenna.

It is shown that a change in wavelength is equivalent to merely rotating the antenna through a fixed angle. Hence the pattern of the infinite structure would be independent of frequency, except for a rotation of the radiated field about an axis perpendicular to the antenna. Within the necessary limitation imposed by the one fixed length this is shown to be true for the finite size structure.

For frequencies such that the antenna arms are very short in terms of wavelength, the radiated field is linearly polarized. As the arm length is increased (or frequency increased) the field on the axis perpendicular to the plane of the antenna, becomes elliptically and then circularly polarized. Since there are no distinctive changes in pattern shape, this change in field polarization is used as a criterion for specifying the cutoff of the pattern bandwidth. The upper and lower cutoffs are independent, the upper being determined by the fineness of construction of the spiral at the feed point and the lower by the arm length. Pattern bandwidths in excess of 20 to 1 have been recorded and there is no indication that this bandwidth could not be extended indefinitely. Radiation patterns are presented for a wide range of antenna parameters.

The input impedance is shown to converge rapidly with increasing frequency and for the antennas of most interest the slot version is rarely mismatched more than 3 to 1 to a 50 ohm line, and is usually 2 to 1 or better over the radiation pattern bandwidth.

The near fields on the antenna were probed and the amplitude and phase distributions are presented. The efficiency of the basic antenna (constructed without lossy dielectrics) is approximately 98% over the useable band of frequencies. 155 pages. $2.05. Mic 58-4397

REFLECTION OF VERY SLOW ELECTRONS FROM PLATINUM AND SINGLE-CRYSTAL GERMANIUM

(Publication No. 23,436)

Howland Auchincloss Fowler, Ph.D.
Brown University, 1957

Electron reflection from surfaces of polycrystalline platinum and single-crystal germanium has been studied in the very-low primary energy range (0-2 ev). Three theoretical pictures for reflection coefficient of normally incident electrons are discussed: the one-dimensional barrier model, electron diffraction, and the Becker-Brattain model. A review of previous experimental work in the very-low primary energy range is presented. Primary energy spread in the present experiment is reduced by use of a single focussing electrostatic analyzer. Contact potential difference between target and collector is corrected by means of the Kelvin method. Targets are cleaned by a cyclic process of outgassing, argon-ion bombardment, and annealing. Results on polycrystalline platinum show a maximum at 2-3 ev and a sharp rise near the zero of primary energy, which is attributed to a patch effect. Results on single-crystal germanium after cleaning and annealing show a low reflection coefficient with downward curvature in the very-low primary energy region, reaching a value 0.07 ± 0.01 at the limiting primary energy between 0.2 and 0.3 ev. Results for etched germanium, adsorption of gas, and argon bombardment are presented. Interpretation in terms of theoretical models is discussed.

82 pages. $2.00. Mic 58-4398

CONDUCTIVITY PROBLEMS IN QUANTUM THEORY

(Publication No. 25,248)

Daniel Charles Mattis, Ph.D.
University of Illinois, 1957

A quantum-mechanical theory of conductivity is derived from first principles by evaluating the velocity

operator associated with the Scroedinger formalism between the wave functions of the Hamiltonian including the electric field. This scheme is contrasted with the density matrix approach, and it is argued that they have the same physical content although the present method is more convenient to apply. A general formula for the conductivity is derived, in terms of the equilibrium parameters, that is, the equilibrium wave function (including scattering) and the distribution function. Terms are only retained to first order in the electric field, in this derivation based on the usual time-dependent perturbation analysis.

In the final sections of the work, the general formula is applied to the following problems of interest in microwave absorption studies: (a) derivation of the anomalous skin effect and of Ohm's law, (b) the Hall effect in the anomalous skin region, (c) cyclotron resonance in metals and semiconductors, (d) mircowave absorption by superconductors, and (e) the dielectric constant associated with plasma oscillations. 63 pages. $2.00. Mic 58-4399

FORMATIVE TIME LAGS OF GLOW DISCHARGES IN AIR, NITROGEN, OXYGEN, AND ARGON

(Publication No. 22,961)

Alex Mayer, Ph.D.
New York University, 1954

Adviser: Professor Leon H. Fisher

Formative time lags of breakdown were measured in air, nitrogen, argon and oxygen for gaps which were illuminated with ultraviolet light. Brass disk electrodes were used at separations large compared to the electrode diameter, and glass chambers of two different internal diameters were employed. Pressures of about 1 mm Hg were used in order to simulate as nearly as possible the conditions in a conventional glow discharge tube. Previously no time lag experiments had been performed with any of the above gases in combination with brass electrodes.

Time lags ranging from about 1000 microseconds at low overvoltages to about one or two microseconds at higher overvoltages were observed in all four of the gases, although the time lag versus overvoltage curves differed considerably for each gas.

Electrode separations of 4 and 10 centimeters were studied and the ultraviolet illumination was varied. Due to the large difference in the ratio of electrode separation to electrode diameter and to the proximity of the floating glass walls to the discharge column, the time lags varied in a complicated way with overvoltage. The order of magnitude and the shape of the time lag versus overvoltage data lend themselves to interpretation in terms of simplifications of Schade's and Raether's models of breakdown. The importance of space charges at larger overvoltages is pointed out. 111 pages. $2.00. Mic 58-4400

A STUDY OF THE SENSITIVITY OF A PARAMAGNETIC RESONANCE SPECTROMETER

(Publication No. 25,382)

Harihar Misra, Ph.D.
Stanford University, 1957

The detection of electron paramagnetic resonance absorption in biological materials requires very high sensitivity of the spectrometer. A systematic study of the sensitivity of such a spectrometer is presented in this report.

Calculations show that a spectrometer employing a reflection-type cavity, as part of a magic T bridge, and a superheterodyne receiver is capable of the highest possible sensitivity; but, though the superheterodyne receiver can be about 10^9 times more sensitive than a crystal or a bolometer detector, a paramagnetic resonance spectrometer using the superheterodyne receiver can have, under the most favorable conditions, only about five times more sensitivity than one using any other type of receiver. Also, the realization of this sensitivity requires the klystron oscillator to have a frequency stability of the order of one part in 10^{12}.

The design and construction of a spectrometer employing a reflection-type cavity in a hybrid T bridge and a superheterodyne receiver are described. The main features of the system are the use of a two-resonator klystron oscillator, a synchrodyne system to derive the local oscillator power, a magic T type balanced mixer followed by a double-input intermediate-frequency amplifier, and a tunable sample-carrying cavity along with an almost identical cavity to balance the magic T bridge.

Several tests of the experimental operation of the spectrometer are described and some results are graphically presented. The tests include a study of the variation of the noise figure of the receiver with the microwave carrier power at its input, the stability of bridge-balance and its effect on the noise figure of the receiver, with resistive terminations and tuned cavities, respectively, placed on the colinear arms, the effect of the magnetic field and its modulation on bridge-balance, the relative merits of a tuned cavity and a resistive termination as balancing devices and the effect of frequency modulation of the klystron oscillator on the local oscillator channel.

Finally, a few paramagnetic resonance-absoprtion spectra for samples of known concentration are presented to illustrate the operation of the instrument as a spectrometer. The absorption signal obtained with a sample of 1.1×10^{-11} mole of diphenyl picryl hydrazyl, dissolved in purified benzene, is about five times noise and by extrapolated calculation from the known data the minimum detectable (with signal-to-noise ratio unity) quantity of crystalline diphenyl picryl hydrazyl is 8×10^{-14} mole, which checks well with the theoretically calculated value of 7.8×10^{-14} mole.

A few suggestions for improving the spectrometer are also given. 149 pages. $2.00. Mic 58-4401

PHYSICS, METEOROLOGY

THE DIURNAL VARIATION OF THE WIND STRUCTURE

(Publication No. 21,761)

Kajit Buajitti, Ph.D.
New York University, 1957

Adviser: Alfred K. Blackadar

The diurnal variation of winds, when the coefficient of eddy viscosity is of the form $K = k(1 + \eta \cos \omega t)$ is studied theoretically. In this form k and η are constant, where k is the mean eddy viscosity and η is the relative amplitude of the daily march of eddy viscosity. The resulting wind variation obtained by this method does not agree well with the results obtained by observations. Wind distributions are obtained by an electronic differential analyzer for various dependencies upon height and time of the coefficient of eddy viscosity. It appears that a distribution of eddy viscosity which attains a maximum value at low levels and then rapidly decreases with height gives a wind distribution similar to what is observed. Such distributions of eddy viscosity are given by $K = k(z) + L(z) \cos \omega t$ and $K = k(z)(1 + \eta \cos \omega t)$.

Various time functions other than sinusoidal have been used. The main feature of the wind variations is not very different whether sinusoidal or other time functions are used, as long as the times of maximum and minimum of eddy viscosity are not changed. Thus the effect of the dependence of the eddy viscosity upon height plays an important role in explaining observed wind variations.

105 pages. $2.00. Mic 58-4402

THE EFFECT OF SIZE AND TIME ON THE FUSION OF THREE TO TWENTY MICRON WATER DROPLETS

(Publication No. 24,632)

John Arthur Day, Ph.D.
Oregon State College, 1957

Major Professor: Larry Schecter

Droplets of distilled water as small as a few microns in diameter were deposited on the surface of a copper plug. Time lapse motion pictures were taken of the droplets and the temperature indicating microammeter simultaneously as the droplets were frozen and melted. Analysis of these pictures showed that on the average the smallest droplets froze at the lowest temperatures. Individual droplets of the same size did not always freeze at the same temperature, however. The resulting statistical distribution confirms and extends the results of other observers to smaller droplet sizes. In addition these data yielded information about the water-ice interfacial surface energy.

Studies of the time rate of freezing of droplets of various size classes, used in conjunction with the theory of Pound and Turnbull, also provided an approach to the determination of this surface energy. The data suggest two distinct nucleation processes, and the surface energies were computed for both. 67 pages. $2.00. Mic 58-4403

UPPER TROPOSPHERIC CONDITIONS DURING SURFACE TORNADIC ACTIVITY

(Publication No. 25,131)

Clifford John Murino, Ph.D.
St. Louis University, 1957

The purpose of this investigation is the determination of the upper level conditions during periods in which surface tornadic activity is known to have occurred, and the relationship of these conditions to the contemporaneous conditions in the lower atmosphere. Since, however, the method of analysis of upper level charts used in this study is contingent upon the treatment of the tropopause surface, it is first necessary to devise a workable method of treatment of that surface.

A period in March, 1953, is selected for the first portion of the study. From the soundings for each reporting station in North America the height and potential temperature of all possible tropopause levels are determined; and, for each of these stations, a tropopause height-versus-time graph is constructed. It is learned that a single tropopause surface can be found which will satisfy the following criteria:

I. It must be continuous in time.
II. It must not require excessively large local variations in potential temperature at the tropopause level.
III. It must satisfy the contemporaneous thermal conditions on the upper level constant pressure charts as dictated by an analysis using Kochanski models.

The tropopause surface which satisfies these three criteria is, at the same time, a surface which is continuous in space.

A period in April, 1956, is next selected for analysis. During this period nearly sixty tornadoes were reported in the Midwest. All surface and upper level charts are constructed for the period, as are the tropopause charts, tropopause pressure change charts, and vertical cross sections. In addition, special time-line sections from Las Vegas to Nashville for the surface and tropopause are prepared. It is demonstrated that:

(1) There is a close relationship between the position of tropopause ridge lines and the position of surface squall lines. The two lines appear to be coincident and move together during tornado periods.
(2) The intensification of the ridge line is caused by strong convergence and upward vertical motion in the upper troposphere in the region of the ridge line.
(3) If the method of tropopause analysis used in this study were performed on a routine operational basis, the tropopause ridge lines, which would aid in the forecasting of surface tornadic activity, could be located. Furthermore, the development of a tropopause configuration having a complex network of minor ridge and trough lines superimposed upon the primary pressure distribution will precede by thirty-six hours the occurrence of tornadoes provided the low-level requirements regarding moisture distribution and instability are met.
(4) The conditions at upper levels can exert a modifying influence upon the normal diurnal frequency of tornado occurrence.
(5) The use of a "select" isotherm at 200 mb in

connection with areas of tornadic activity, as suggested by some authors, is not realistic. A more fruitful approach would be to deal directly with the cold pool (area of relatively low temperature) at 200 mb without regard to temperature value.

(6) A cold pool at 200 mb is found along the tropopause intersection with that constant pressure surface. The region of cold air along this tropopause intercept is produced by the same upward vertical motion field that produces the tropopause ridge and is, therefore, intimately related to the region in which tornadoes occur.

114 pages. $2.00. Mic 58-4404

PHYSICS, NUCLEAR

THERMODYNAMICS AND STATISTICAL MECHANICS OF THE OVERHAUSER EFFECT IN METALS

(Publication No. 25,117)

Edward A. Desloge, S.J., Ph.D.
St. Louis University, 1957

Considering the magnetic interaction between the conduction electrons and the nuclei of a metal in a magnetic field, Overhauser showed that, if the contact term in the dipole-dipole interaction is the predominant interaction, then it is possible by saturating the electron spin resonance to obtain a high degree of nuclear polarization. This effect is known as the Overhauser effect.

A rather general thermodynamic and statistical mechanical derivation of the Overhauser effect was worked out subsequently by Brovetto, Cini, and Ferroni.

The work of Brovetto, Cini, and Ferroni was extended to include the non contact terms in the dipole-dipole interaction and was justified on the basis of the thermodynamics of irreversible processes by Barker and Mencher.

The results of the above mentioned authors have been extended in this dissertation. It has been found possible with the use of a very simple model, in which the conduction electrons and the nuclei in a metal are divided into a set of subsystems, one subsystem for each spin state, to obtain the basic results associated with the Overhauser effect in metals.

Each subsystem is treated as a separate chemical species, and the interactions between the subsystems treated as chemical reactions. With each subsystem a chemical potential is associated. In this manner a complete description of a system under steady state Overhauser polarization is possible. The basic thermodynamic functions associated with such a system are obtained. The special case in which the nuclei have negative magnetic moment is discussed in detail.

It is found that, for appropriate values of the electron spin resonance saturation and magnetic field, the nuclear spin contribution to the specific heat can be made to predominate over other contributions at temperatures of the order of one degree Kelvin.

The use of chemical potentials permits non equilibrium spin distributions to be described without the notion of spin temperatures, avoids many of the difficulties associated with spin temperatures, and is in general of wider validity. A detailed comparison of the two approaches is made.

Specific expressions are obtained for the entropy production and power dissipated by a metal under steady state Overhauser polarization. The technique employed in obtaining these results is simpler than that employed by other authors, and the results are more general.

197 pages. $2.60. Mic 58-4405

MODIFICATIONS OF THE BREIT INTERACTION

(Publication No. 24,786)

Stanley Maurice Forman, Ph.D.
New York University, 1955

Adviser: Dr. Robert D. Hatcher

We have sought to find a modification of the Breit interaction: $e_1e_2(1/r - \frac{1}{2}\vec{\alpha}_1 \cdot D \cdot \vec{\alpha}_2)$, which while retaining the proved features of this treatment of the retardation in the interaction of two electrons, would avoid the difficulties of the e^4 spin-spin term, which arises in the process of reducing the resultant 16-component equation to an equation in the four 'large' components.

We have examined, using the large component and Foldy-Wouthuysen reduction methods, the following three modifications of the Breit interaction:

(1) $$e_1e_2\,(1/r - (1/4c)\,(\frac{1}{m_2}\vec{\alpha}_1 \cdot D \cdot \vec{\rho}_2 + \frac{1}{m_1}\vec{\alpha}_2 \cdot D \cdot \vec{\rho}_1))$$

(2) $$e_1e_2\,(1/r - (1/8c)\,(\frac{1}{m_2}\vec{\alpha}_1 \cdot [\vec{\alpha}_2 \cdot \vec{\rho}_2, \vec{\alpha}_2 \cdot D]_+ + \frac{1}{m_1}\vec{\alpha}_2 \cdot [\vec{\alpha}_1 \cdot \vec{\rho}_1, \vec{\alpha}_1 \cdot D]_+))$$

(3) $$e_1e_2\,(1/r - (1/8c)\,(\frac{\beta_2}{m_2}\vec{\alpha}_1 \cdot [\vec{\alpha}_2 \cdot \vec{\rho}_2, \vec{\alpha}_2 \cdot D]_+ + \frac{\beta_1}{m_1}\vec{\alpha}_2 \cdot [\vec{\alpha}_1 \cdot \vec{\rho}_1, \vec{\alpha}_1 \cdot D]_+))$$

All three modifications eliminate the e^4 term from the reduced equations. It is found, however, that (1) also eliminates all spin-spin interactions, and is therefore in disagreement with experiment. (2) and (3) are both in agreement with experiment, agree with each other for cases of positive energy for both particles and are thus in agreement with the Breit interaction if one drops the e^4 term from the latter. It is found that (2) leads to incorrect consequences for states of negative energy for both particles and for states of positive energy for one particle and negative energy for the other particle.

We find that (3) avoids the difficulties of (2), and most important, is shown to be in agreement with the Heisenberg-Pauli quantum electrodynamics, in that its first-order perturbation energy is equal, to terms in $1/c^2$, to that predicted by the H-P theory; its second-order perturbation does not introduce any additional energy terms of order $1/c^2$, as does the Breit interaction.

The equivalence of (3) with the H-P electrodynamics also provides, incidentally, proof that our results are

relativistically invariant in the same sense as Breit's, and proof of equivalence of the results of using (3) in collision problems, with the results of the Møller collision theory.

As subsidiary conclusions we find: 1. The L.C. and F-W reductions of the various wave equations differ only in that the F-W method provides a Hermitian form of the equation produced by the L.C. method. 2. It is clear that the agreement of the Breit interaction with the H-P theory does not provide a unique proof of the correctness of the former, since we have shown that interaction (3) is also in agreement with and therefore derivable from the H-P theory. 101 pages. $2.00. Mic 58-4406

SMALL ANGLE PHOTOPRODUCTION OF POSITIVE PIONS FROM HYDROGEN AT 225 MEV

(Publication No. 25,245)

John Holmes Malmberg, Ph.D.
University of Illinois, 1957

The angular distribution of π^+ photomesons produced in hydrogen by photons of energy 225 Mev has been measured in the small angle region. Points have been obtained at center-of-mass angles of 10, 15, 20, 30, 45, 60, and 90 degrees.

The small angle region is one not previously well explored because of difficulties with the high intensity of electron pair background. In this experiment the pair background has been avoided by use of a very short x-ray burst and a counter system which operates only after the burst, counting the decays of μ^+ mesons. A focussing magnet is used to select mesons of the desired momentum. The mesons are produced in a liquid hydrogen target placed in the x-ray beam of the 300 Mev betatron.

The observed angular distribution cannot be fitted by a quadratic in cos θ^*, but is well fitted by the cross section calculated from the field theory of Chew, Goldberger, Low and Nambu. 131 pages. $2.00. Mic 58-4407

THE PHOTONEUTRON CROSS SECTIONS OF Li^6 AND Li^7

(Publication No. 24,801)

Thomas Andrew Romanowski, Ph.D.
Case Institute of Technology, 1957

The absolute photoneutron cross sections for Li^6 and Li^7 were determined from the yields detected by means of a neutron detector. The efficiency of the neutron detector was determined from the comparison of the detected and computed copper neutron yields. In the calculation of the cross sections the inverse photon matrix formulation of the photon difference method was used. The Li^6 cross section has a peak at about 12.5 Mev. and its absolute value at the peak is equal to $2.8 \pm .53$ mb. The Li^7 cross section has a peak at about 14 Mev. and its absolute value at the peak is equal to $3 \pm .75$ mb.

44 pages. $2.00. Mic 58-4408

DOUBLE NUCLEAR MAGNETIC RESONANCE AND THE DIPOLE INTERACTION IN SOLIDS

(Publication No. 25,388)

Lynn Redmon Sarles, Ph.D.
Stanford University, 1957

The nuclear magnetic dipole interactions in a polycrystalline sample of sodium fluoride have been investigated using an extension of the magnetic resonance technique. The resonance absorption of Na^{23} was observed with a variable frequency spectrometer in a fixed external magnetic field, and the mean square width of the line shape computed.

This width has two main sources: (a) the interaction of Na^{23} nuclei with other Na^{23} nuclei through the dipole fields of the magnetic moments, and (b) the interaction of Na^{23} nuclei with neighboring F^{19} nuclei by the same mechanism. The application of a strong rf field, satisfying the resonance condition for F^{19} nuclei in the same external field, caused rapid transitions between the fluorine Zeeman energy levels, and thus altered the average field produced at the position of sodium nuclei by the nuclear magnetic moments of fluorine. By varying the strength of this rf field and also by varying the deviation from precise resonance of the F^{19} spins, one could selectively alter the contribution of this source of line broadening.

The availabe rf field was not sufficiently intense to eliminate entirely the broadening caused by source (b). However, the detailed behavior of this contribution to the width as a function of the deviation from resonance agrees well with a theory of F. Bloch for the case of the rf field strong compared to the line widths involved.

65 pages. $2.00. Mic 58-4409

RADIOACTIVE DECAY OF TUNGSTEN 185

(Publication No. 25,138)

Sebastian C. Thashathu, Ph.D.
St. Louis University, 1957

A search for a γ-ray reported by some workers in W^{185} has been carried out using two batches of the W^{185} isotope obtained from the Oak Ridge National Laboratory. The NaI scintillation spectrometer and the thin lens β-ray spectrometer in the St. Louis University laboratory were suitably modified for this purpose.

The modification in the scintillation spectrometer enabled (1) accurate energy measurement of the x-rays emitted by the isotope, (2) detection of a very weak γ-ray and (3) the determination of the K-conversion coefficient of the γ-ray. The use of absorbers to detect a weak γ-ray and to measure its relative intensity when accompanied by intense x-rays is a technique developed during this investigation.

In the β-ray spectrometer, a scintillation detector was introduced in place of the commerical end-window type G. M. tube previously used. A lowering of the cut-off energy of the instrument from 84 to 30 keV and an increase in the figure of merit by 60% was achieved by this means.

The NaI scintillation spectrometer measurements

showed the presence of Re x-rays and a highly converted γ-ray of energy 135 keV while the study of the β spectrum of W^{185} revealed the presence of weak conversion lines that can be ascribed to the above γ-ray. The possibility of impurities like W^{181} causing the observed results has been carefully examined. The evidence obtained leads to the conclusion that a γ-ray of energy 135 $\pm$ 1.5 keV and K-conversion coefficient 28 $\pm$ 5 is associated with the decay of W^{185} and a low intensity β spectrum of end-point energy 303 $\pm$ 5 keV is likely to be present as a process competing with the predominant β spectrum of energy 438 $\pm$ 5 keV. The scheme proposed by other workers for the decay of W^{185} has been shown to be inconsistent with the present results and a new scheme which satisfactorily explains the experimental results has been tentatively proposed.

123 pages. $2.00. Mic 58-4410

PHYSIOLOGY

STUDIES ON THE OXYGEN CONSUMPTION OF NON-NUCLEATED ERYTHROCYTES

(Publication No. 23,710)

Luis Angelone, Ph.D.
The Ohio State University, 1952

Erythrocytes obtained by cardiac puncture and pooled from a large number (20 to 43) of male, white rats (100 to 150 g.) or by venous puncture for individual study from patients with or without thyroid disturbances were washed twice, centrifuged to constant volume, and resuspended in an equal volume of Krebs' solution. The oxygen consumption of x-irradiated and non-irradiated erythrocytes from "normal" rats and from "normal" rats injected with ACE (Upjohn's Adrenal Cortical Extract in saline and 10 per cent alcohol) subcutaneously once per day per rat for 10 to 15 days prior to isolation was studied by means of the Warburg technique over various periods of time (1 to 6 days). All pools, x-irradiated and control, were paired. Red-cell suspensions were refrigerated (2° to 8° C.) and were returned to room temperature (25° to 30° C.) long enough to withdraw aliquot samples for the determination of their oxygen consumption.

Patients of both sexes were divided, on the basis of their clinical diagnoses (primarily based on blood protein-bound iodine), into four groups as follows: (1) patients with no indication of thyroid disturbances (euthyroid), (2) untreated hyperthyroid patients, (3) hyperthyroid patients treated with 10 drops of Lugol's solution 3 times daily for 14 to 21 days (not the same patients as found in group 2), and (4) untreated hypothyroid patients.

The various studies on nonnucleated red-cell metabolism may be grouped into four categories, with the respective, salient conclusions summarized as follows:

1. Aging (storage) on oxygen consumption. A total of 24 red-cell pools (32 to 43 rats per pool, 2 to 3 ml. blood per rat) was studied over a period of 1 to 6 days. In general, there is no significant difference in oxygen consumption whether determined at the time of withdrawal of the red cells or after overnight storage. The mean Q_{O_2} (-cmm. O_2 consumed/hour/mg. dry weight) and the mean cmm. of oxygen consumed per billion red cells on the day of withdrawal are 0.09 and 2.26 respectively. Although values for the oxygen consumption of the different pools vary quantitatively rather greatly, nevertheless the slopes of all curves representing the oxygen consumption of the various red-cell pools when plotted as functions of time are relatively similar. It may be concluded that there is a progressive decrement in the oxygen consumption from zero (withdrawn) day to the sixth day, at which time a typical pool shows a net decrease of 30 per cent in oxygen consumption.

2. Various dosages of x-irradiation in vitro on the oxygen consumption.

a. Three, two, and eight different batches of pooled (32 to 43 rats per pool) red-cell suspensions were irradiated with 10,000, 20,000, and 30,000 roentgens, respectively. When oxygen consumption per billion red cells is plotted against time in days (3 to 4 days), an increase in respiration is observed, as compared with the paired controls, for all roentgen doses studied.

b. The two lower dosages (10,000 r. and 20,000 r.) show an initial transitory increase in oxygen consumption, after which the values decrease at rates comparable with those of the aging, paired controls. The curves representing these two dosages are relatively congruous.

c. The higher (30,000 r.) differ from the lower (10,000 r. and 20,000 r.) dosages in that the initial transitory increase in oxygen consumption is maintained throughout the course of the experiment (4 days), although the respiration of the paired control red-cell pools show a linear decrease. Viewed otherwise, these cells show no aging effects from a metabolic viewpoint during the same period.

3. Adrenocortical extract (ACE) on the respiration of x-irradiated red cells. A total of 10 different red-cell pools (18 to 25 rats per pool) were studied. One-half of these pools were obtained from rats previously treated with ACE; the remainder served as controls. After exposure of these paired pools to 15,000 r. dosages, their oxygen consumptions (per billion red cells) were determined immediately (within 1 hour) and 21 hours after x-irradiation. A comparison of the oxygen consumption of ACE-roentgen-treated and roentgen-treated, paired red-cell suspensions shows that while the former give a 8 per cent decrease at the end of the first hour, the latter give a 38 per cent increase. This suggested that ACE, under the experimental conditions involved, protects (antagonizes) the metabolism of red cells from the stimulatory effect invoked by x-irradiation. After a 21-hour interval the respiration of both pools becomes congruous. Further study of red-cell pools in this connection should be made.

4. The oxygen consumption of erythrocytes from euthyroid, hyperthyroid, iodine-treated hyperthyroid, and hypothyroid patients. Non-irradiated erythrocytes from 39 patients were studied. When compared with the untreated hyperthyroid group, the euthyroid and hypothyroid groups are statistically significant ($P < 0.04$ and $P < 0.01$ respectively), whereas the iodine-treated hyperthyroid group is not ($P < 0.20$). The mean Q_{O_2} values of the

different groups reflect the degree of thyroid activity when plotted as a function of the protein-bound iodine.

78 pages. $2.00. Mic 58-4411

Abstract published by special arrangement with The Ohio State University.

THE PHYSIOLOGICAL BASIS FOR THE METABOLIC GRADIENT IN THE SMALL INTESTINE OF THE CAT

(Publication No. 25,208)

Homer Lee Dorman, Ph.D.
University of Illinois, 1957

The metabolic gradient of the small intestine, previously reported by Alvarez, has been studied using the Warburg technique. Data were accumulated from intestinal segments of 41 adult cats of both sexes and mixed breeds. Observations on the oxygen consumption and the rate of mechanical activity of intact segments excised from seven equally spaced areas along the small intestine, confirm the existence of an aboral gradient in muscular and metabolic activity. The regression coefficient of the metabolic gradient of intact segments amounted to 1.37 μl/gr/hr/cm of intestinal length. The submucosal and mucosal layers were shown to account for approximately 20% of the slope of the gradient of intact segments. However, whether or not this small gradient results from graded activity of the muscularis mucosae or is produced by graded secretory and/or absorptive processes remains to be demonstrated.

The oxygen consumption of segments of the isolated circular muscle layer were found to be essentially randomized, and statistical treatment of these data revealed no tendency towards gradation. Furthermore, mechanical removal of either Meissner's or Auerbach's ganglionic plexus abolished the graded oxygen consumption attributed to the muscle layers. The metabolic gradient is suggested to result from graded nervois stimulation which originates in the intrinsic ganglia of the intestinal wall. This view was strengthened by studies which showed that addition of a ganglionic blocking drug (0.0005 hexamethonium chloride) to the Warburg medium abolished the gradient exhibited by intact segments.

In conclusion it may be said that the contention of Alvarez that peristaltic waves move aborally as a result of a metabolic gradient of the muscle layers is untenable in view of the finding that this gradient is directly dependent upon functional stimulation of the smooth muscle layers by the intrinsic ganglia of the intestinal wall.

79 pages. $2.00. Mic 58-4412

THE EFFECT OF TEMPERATURE AND ACID BASE BALANCE ON THE ERYTHROCYTE SEDIMENTATION RATE IN MAN

(Publication No. 25,231)

Barbara Jane Howell, Ph.D.
University of Illinois, 1957

The importance of the erythrocyte sedimentation rate in clinical studies makes imperative a method which controls as many experimental variables as possible and which is accurate enough to use as a research tool in the evaluations of pathological and physiological changes in the ESR.

A method is described in which the ESR is determined at 100 F $\pm$ one degree. Wintrobe sedimentation tubes are used, readings are made at ten minute intervals for one hour and the rate of sedimentation in mm/min. is calculated. The hematocrit is determined and all ESR's are corrected to a cell concentration of 47 vol % by the Rourke-Ernstene chart.

An investigation of the effect of the external temperature on the ESR revealed that an increase in temperature increased the ESR, but that this relationship was not linear. The acceleration of the ESR was greater between 85 and 100 degrees Fahrenheit than between 70 and 80 degrees Fahrenheit. There was an inverse relationship between the ESR and temperature between 80° and 85° F.

A correlation between temperature and viscosity of the blood has been shown.

A distribution curve of normal values for the ESR as run by our method is included. An analysis of 239 erythrocyte sedimentation rates on 100 normal young men places the mean ESR at 0.44 mm/min. with a standard deviation of $\pm$ 0.30 and a standard error of the mean of $\pm$ 0.0013.

A study of the effect of gas tensions overlying the blood indicates that high oxygen tensions accelerate the ESR but not significantly.

Since exercise, starvation, high fat diets and an in vitro metabolic acidosis elevate the ESR, it is suggested that this test is sensitive to alterations in acid-base balance.

64 pages. $2.00. Mic 58-4413

AN ACCESSORY ASCENDING PATHWAY IN THE NERVOUS SYSTEM OF THE CAT

(Publication No. 24,871)

Milton Kletzkin, Ph.D.
New York University, 1957

Adviser: Dr. C. W. Hampel

The persistence of evoked potentials in the higher centers of experimental animals after interruption of the major ascending systems indicates the existence of alternative or accessory sensory pathways. This is corroborated by the persistence of sensation in humans subjected to similar surgery. A spinotectal tract — tectum — hypothalamus route was suggested which could operate in lieu of the classical pathways.

Electrodes were placed stereotaxically into the tectum, thalamus and hypothalamus of cats under pentobarbital

anesthesia. Stimulation of the contralateral sciatic nerve evoked potentials in the inferior colliculus. Subsequent to a lesion involving the terminus of the spinothalamic tract, the nucleus ventralis posterolateralis of the thalamus, evoked potentials appeared in the hypothalamus, or those previously present were enhanced. These potentials were abolished by electrocoagulation of the site of the tectal potentials. It was concluded that the proposed pathway did exist.

Since stimulation of any part of this pathway, peripheral nerve, tectum mesencephali or hypothalamus, in unanesthetized humans and animals has been shown to produce pain, it was further concluded that the accessory pathway demonstrated in these experiments was a pain conduction system.

In an attempt to identify the thalamic loci whose destruction resulted in hypothalamic activation lesions were produced in the nucleus ventralis lateralis, nucleus centralis lateralis, nucleus ventralis anterior, nucleus lateralis posterior, the lateral and medial geniculate bodies and the nucleus ventralis posterolateralis. Only lesions involving the nucleus ventralis posterolateralis were succeeded by enhancement of evoked hypothalamic potentials. The hypothalamic potentials themselves were detected only in the anteromedial portions of that structure.

It is believed that these findings may account for certain features of the pain characteristic of the Dejerine-Roussy syndrome, a disturbance associated with lesions of the posteroventral thalamus. The hypothalamic portion of the accessory pathway may explain the emotional reactions and vegetative disturbances frequently seen in this disorder.

Some of the anatomic pathways which may be involved in the transmission of impulses from the mesencephalon to the hypothalamus have been described.

Combining electrical stimulation of the sciatic nerve with a nociceptive stimulus (immersion of the hindleg in painfully hot water) produced highly variable effects on the evoked potentials recorded in the tectum. These ranged from considerable enhancement to complete suppression.

86 pages. $2.00. Mic 58-4414

FUNCTIONAL REACTIVATION OF HYPOTHERMIC HEART AFTER POTASSIUM ARREST

(Publication No. 25,171)

Larry Joe O'Brien, Ph.D.
The University of Texas, 1957

Supervisor: M. Mason Guest

The induction of hypothermia in the dog is often associated with cardiac arrhythmias of which ventricular fibrillation presents the biggest problem. One method of stopping fibrillation is to inject potassium chloride into the coronary circulation. Fructose has been shown to be highly effective in reducing the levels of circulating plasma potassium and exhibits a remarkable capacity to bring about a reversal of the abnormalities which occur in the hyperkalemic state.

Heart-lung preparations were used to study the effects of hypertonic fructose in the restoration of functional cardiac activity following potassium arrest. Mongrel dogs were anesthetized and subjected to the conventional Starling heart-lung preparation, with slight modifications. After allowing the preparation to stabilize, hypothermia was induced by lowering the temperature of the water bath surrounding the venous blood reservoir. When the desired temperature was reached, the pericardium was opened and fibrillation was produced by faradic stimulation to the left ventricle. Fibrillation continued for 17 to 240 seconds, after which it was stopped by a rapid retrograde injection into the brachiocephalic artery of potassium chloride in Ringer-Locke solution. Following a complete cardiac arrest of a mean of 10 minutes, 10 to 25 cc. of 50 per cent fructose in Ringer-Locke solution were added to the venous reservoir and cardiac massage initiated. Slow cardiac massage was continued until graphic registration of heart activation occurred. Measurements of cardiac output, mean arterial pressure, mean peripheral resistance, and mean venous pressures were made periodically. Values obtained prior to fibrillation and following restoration of cardiac function were approximately the same.

Continuous electrocardiographic tracings were taken. Heart rates before and after functional reactivation were essentially the same. Electrocardiographic changes in the restored hearts were usually absent. Immediately following the restoration of the heart, there was an absence of the P wave, a prolonged QRS interval and a large, sometimes diphasic T wave. As the state of hyperkalemia was reduced to lower levels by fructose, the P wave returned and was followed by a normal QRS sequence. The T wave reverted to a monophasic pattern and, with the passage of time, returned to normal.

Blood samples were taken at regular intervals throughout the experiments, for measurement of plasma sodium, potassium, and glucose levels. Samples of the myocardium were taken at the termination of the experiments for analyses of sodium, potassium, and glycogen. There was a marked increase in myocardial levels of potassium and glycogen.

No gross indication of impairment of restored cardiac function as a result of fibrillation, arrest, or alterations in potassium and fructose concentrations were observed.

65 pages. $2.00. Mic 58-4415

EVIDENCE FOR LINKAGE BETWEEN BIOELECTRIC POTENTIALS AND CYTOCHROME OXIDASE

(Publication No. 25,172)

James Nicholas Pratley, Ph.D.
The University of Texas, 1957

Supervisor: H. F. Rosene

Evidence is presented which demonstrates that continuously maintained bioelectric potentials in the intact onion root and isolated frog skin are linked with the activity of cytochrome oxidase. By the use of new techniques, it was possible to test the effect of carbon monoxide and light on the potentials of the onion root and frog skin without mechanical stimulation or change in humidity or temperature.

Experiments on the onion root were carried out on the

region designated in this work as the "root-apex," a region possessing a unidirectional potential gradient. The potential of the onion root-apex is reversibly depressed by a mixture of 80 per cent CO and 20 per cent O_2 in the dark. Light of sufficient intensity applied uniformly to the entire region between the contacts completely reverses the effect of CO depression of the potential. The depression of the normal electrical polarity denotes that the distal electropositive regions of the root-apex are affected more by CO than are proximal regions.

The unequal effect of equal concentration of CO on different regions of the root-apex is demonstrated by localized application of light to (a) distal and (b) proximal regions of the root-apex when exposed to the CO mixture. Illumination of the distal regions of the root-apex when exposed to CO reverses the CO depression of the potential to a greater extent than when the entire region of the root-apex is illuminated, while illumination of the proximal regions of the root-apex when exposed to CO does not reverse the CO depression of the potential.

The dissimilarities of results from illumination of (a) distal and (b) proximal regions of the root-apex when exposed to CO and the specificity of CO as an inhibitor of cytochrome oxidase plus its reversibility by light show that the activity of cytochrome oxidase is greater in the distal regions than in proximal regions. Histochemical evidence obtained by the use of the Nadi test confirms the existence of cytochrome oxidase in the onion root and its greater activity in the distal regions as compared to proximal regions of the root-apex.

The results furnish a new link in the chain of experimental evidence interrelating electrical, functional, and morphological polarities with oxidative metabolism in the root-apex of the onion; associated with these polarities, there is an enzymatic polarity in the distribution of cytochrome oxidase activity. The results provide also, for the first time, the identification of a specific electromotively active substance (cytochrome oxidase) upon which the potential of the onion root depends, at least in part. Furthermore, the existence of the enzymatic gradient of cytochrome oxidase is predictable by electrical potential measurements on the onion root.

Experiments on the frog skin showed that the potentials of a frog skin are unaffected by a mixture of 80 per cent CO and 20 per cent O_2, and by 90 per cent CO and 10 per cent O_2. A mixture of 95 per cent CO and 5 per cent O_2 depresses the potentials of a frog skin in the dark. Light applied uniformly to both sides of the skin reverses the CO depression. Control experiments with nitrogen/oxygen mixtures indicate that the CO depressions of the potentials are due mainly to CO and not to lack of O_2. The Nadi test confirms the existence of cytochrome oxidase in the frog skin in the same layer (epidermal) which is generally believed to be the seat of the potentials in the frog skin.

122 pages. $2.00. Mic 58-4416

A STUDY OF CONDUCTION IN SMOOTH MUSCLE FROM THE CAT INTESTINE USING EXTERNAL AND INTRACELLULAR RECORDING

(Publication No. 25,289)

Nick Sperelakis, Ph.D.
University of Illinois, 1957

Isolated rings and strips of intestinal circular muscle of the cat were prepared free of nerve ganglia. The rings were mounted tightly in glass rods and placed in a warm, moist chamber. The strips were suspended with threads in the chamber; one thread attached to a transducer to record contractions. Silver-silver chloride electrodes and a DC amplifier were used for external recording. KCl-filled microelectrodes with tip diameters of 0.5 micron or less were used for intracellular recording from rings. The microelectrodes had resistances of 7-30 megohms and tip potentials of 0.5-5.0 mv. An electrometer preamplifier permitted recording with very low grid currents.

Peristaltic-like contraction waves in the rings were observed with a microscope. They propagated longitudinally in either direction for an average distance of about 8 mm. from a non-fixed pacemaker area, and had an average velocity of 1.2 cm./sec. The rings are divided into bands 1.0 mm. in width bounded by connective tissue; these bands appear to be the contractile units, each band contracting successively. Some rings showed the contraction waves around only a fraction of their circumference; others were similarly restricted by the addition of KCl to the bottom of the ring. It is concluded that mechanical and electrical activity can propagate longitudinally along a portion of the circumference of a ring without any activity around the remainder of the circumference. It was determined by simultaneous electrical recording and visual observation that cross-over of electrical activity between two adjacent rings can occur with or without accompanying contraction waves.

Conduction may continue for a time through a clamped region of a strip which does not allow a mechanical wave to pass. Brief stretches applied to a strip did not evoke responses. Tension applied to strips caused the contractile system to temporarily fatigue or become inexcitable while the conduction system remained operable. Adrenaline, insulin, and reserpine applied locally between the stimulating and recording electrodes reversibly blocked conduction and contraction, but the electrical and mechanical activity did not necessarily disappear or reappear simultaneously; barium chloride antagonized the effects of these drugs. It is concluded that conduction in intestinal muscle can occur in the absence of contraction, hence the hypothesis that conduction in intestinal smooth muscle is mediated by mechanical pull between adjacent fibers is untenable.

In view of the relative insensitivity of the circular muscle to physiological concentrations of acetylcholine, eserine, atropine, tubocurarine, tetracaine, and serotonin, the hypothesis that conduction involves the action of a chemical transmitter between the fibers seems unlikely.

The arguments against a syncytium include: (1) lack of interfiber protoplasmic continuity; (2) higher resistance relative to long-fibered muscles, and a marked capacitive reactance; (3) decrementing conduction; (4) multiple electrical response patterns; (5) double-level contractions;

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(6) contractions without apparent conduction; (7) substantial resting potentials. It is concluded that the syncytial and functional continuity hypotheses are untenable.

Since there is overwhelming evidence against nervous conduction, an ephaptic hypothesis of interfiber conduction is suggested; i.e., interfiber transmission is electrical. The phenomenon of electrical cross-over between two adjacent rings is also evidence for electrical transmission.

Intracellular recording from single fibers in response to shocks was obtained. The approximate mean resting potential and action potential were 40 mv. and 22 mv. respectively. Most action potentials were only partial depolarizations, although a very few returned to zero or showed overshoot. The action potential magnitudes were roughly proportional to the resting potential magnitudes. Prepotentials were often observed. Frequently multiple spikes resulted from single shocks. Occasionally double-spikes of equal amplitudes occurred in rapid succession.

107 pages. $2.00. Mic 58-4417

STUDIES OF THE ACTIONS OF ADRENAL CORTICAL HORMONES AND EPINEPHRINE UPON THE EOSINOPHILIC LEUCOCYTE

(Publication No. 24,891)

Oliver Inparatnam Thevathasan, Ph.D.
New York University, 1954

Adviser: Dr. A. S. Gordon

It has been shown in the adrenalectomized female rat that epinephrine induces an eosinophilia at 6 hours following its administration, the intensity of which is proportional to the dose of the hormone administered.

Priming the adrenalectomized rat with one ml. of adrenal cortical extract prevents the rise in eosinophils seen at 6 hours after the administration of each of the three doses of epinephrine. Priming with the 2 ml. dose of cortical extract abolishes the eosinophilia evoked by the 100 and 200 but not in the case of the 50 levels of epinephrine.

In the splenectomized-adrenalectomized rat, no rise in the levels of peripheral eosinophils is observed following the treatment with the 3 dosages of epinephrine. In these doubly-operated rats, 200 of epinephrine actually produces an eosinopenia. The data suggest that increased eosinophil destruction (eosinorrhexis) occurs in both the adrenalectomized and the adrenalectomized-splenectomized rat treated with epinephrine.

Pretreatment of adrenalectomized-splenectomized rats with 1 ml. adrenocortical extract results in a potentiated eosinophenia following injections of each of the doses of epinephrine. In 2 of the 3 groups, synergistic effects upon the production of destroyed eosinophilic forms are observed.

A time factor in the development of the eosinopenia in the adrenalectomized-splenectomized rat has been demonstrated which is dependent upon the dosage of epinephrine employed, thus confirming similar findings made in normal men by Recant et al. ('50). The extent of the eosinopenic reaction also appears to be dependent upon the quantity of epinephrine administered.

It is concluded from the present experiments that the cortical hormones are needed in only "permissive" amounts for the development of the eosinopenic response following epinephrine treatment. This concept would render the cortical steroids of secondary significance to the adrenal medullary factor in influencing the behavior of the eosinophilic leucocyte in peripheral blood.

124 pages. $2.00. Mic 58-4418

EFFECTS OF VARIOUS OXYGEN PRESSURES ON THE PHYSIOLOGY AND THE MORPHOLOGY OF RAT TISSUE MITOCHONDRIA

(Publication No. 25,300)

Leopold John Treciokas, Ph.D.
University of Illinois, 1957

Paul Bert revealed for the first time in 1878 that oxygen at high pressures is lethal. To the present day no accurate information is available regarding the exact mechanism of oxygen toxicity. However, considerable evidence has accumulated during the last decade to indicate that the toxic effect of oxygen may result from excessive formation of unusually stable free radicals and their inactivation of cellular enzyme systems.

There is evidence in the literature to suggest that high oxygen pressures affect enzyme systems associated with the mitochondrial citric acid cycle activity. It is proposed, since mitochondria represent a delicately organized complex enzyme system which is the main site of cellular metabolism, that studies of these particles might possibly elucidate the mechanism of oxygen toxicity. Since oxygen uptake is not an entirely dependable measure of energy utilization, other measurements such as phosphorylation coupled to oxidation and morphological integrity associated with it may give additional information.

To test this hypothesis oxidative phosphorylation studies were made on mitochondria isolated from the livers of healthy male adult rats (250-350 grams). The isolated mitochondria were suspended in 0.44 M sucrose and were exposed to 100 per cent oxygen at pressures ranging from 0.2 - 6 atmospheres for a period of one hour. Immediately following exposure oxidative phosphorylation of mitochondrial suspensions was measured employing the Warburg technique for oxygen uptake and the Gomori method for phosphate fixation. A number of substrates such as pyruvate, alpha-ketoglutarate, succinate, beta-hydroxybutyrate, and reduced cytochrome c were used as electron donors. The results obtained suggest that pre-exposure to high oxygen pressure tend to lower P/O ratios, especially with pyruvate and alpha-ketoglutarate. The uncoupling appears to be the result of decreased phosphorylation since respiratory rate at the oxygen pressures studied was relatively unaffected. It was also observed that P/O ratios decreased with increased oxygen pressure.

Pre-exposure to high oxygen pressure had a definite inhibitory effect on mitochondrial ATP-ase but not on cytochrome oxidase. There appears to exist a definite relationship between the inhibition of ATP-ase activity and the uncoupling of oxidative phosphorylation.

Studies with reduced cytochrome c indicated that part of the uncoupling effect takes place along the electron transfer chain between cytochrome c and oxygen.

Pre-exposure of liver mitochondrial suspensions to 6 atmospheres of 100 per cent oxygen did not produce any morphological deviations from the controls as revealed by their swelling properties in hypotonic media and by their electron micrographs.

Lung mitochondria in situ similarly showed no morphological changes in the animals pre-exposed to high oxygen tensions (1 atm. of O_2 for 38 hours and 3 atm. of O_2 for 8 hours). No evidence was observed which would indicate that osmiophilic bodies (dark-staining inclusions found in alveolar cells) are degenerate forms of mitochondria as has been previously postulated. It is assumed, however, that they are of approximately the same density as mitochondria since both appeared in the same homogenate fraction. 144 pages. $2.00. Mic 58-4419

ELECTRICAL STIMULATION OF THE HUMAN CEREBELLUM

(Publication No. 24,933)

Nicholas Wetzel, Ph.D.
Northwestern University, 1957

Although the first electrical stimulation of the human cerebellum was probably done by Bartholow of Cincinnati in 1874, only a few years after the reports of animal experimentation of Fritsch and Hitzig and of Ferrier, similar studies on stimulation of the cerebellum have not been reported frequently. C. K. Mills in 1914 wrote of having "faradized the exposed folia in order to determine positively whether the operation was on the correct side of the brain," — and Pool in 1943 reported four cases of cerebellar stimulation. Aside from these no systematic studies of cerebellar stimulation have been reported.

There is an adequate background of neurophysiologic and neuroanatomic material to warrant a study of the effect of cerebellar stimulation in the human particularly insofar as the EEG is concerned. Some sixteen patients in the course of routine neurosurgical procedures, done with both local and light general anesthesia, have been subjected to bipolar electrical stimulation of their cerebella, and simultaneous encephalographic recordings of cortical activity made through conventional scalp electrodes. The electrical stimulation of the cerebellar cortex was done using a Grass model 3-A or 4-A stimulator at parameters varying between five and twenty—five volts and between one and 300 stimuli per second. In three patients no response was obtained. In 16 patients stimulation of from one to five areas of the cerebellum caused change in the EEG, and a total of 42 points on the cerebellum were noted to cause change. At 34 of these slowing in the cerebral EEG was produced and was usually accompanied by an increase in voltage. Occasionally an increase in frequency of the EEG was produced and was accompanied by either an increase or decrease in voltage. The EEG change was generalized in 4, and in the others the change was most notable at one or more of the leads. The changes were usually bilateral. No motor response, nor objective or subjective sensory response was noted, nor were any changes in pulse, blood pressure or respiration elicited.

The varying concepts of cerebellar function are reviewed as are the concepts of human cerebellar anatomy. The literature concerning the effects of space occupying lesions of the posterior fossa on the EEG is reviewed.

Electrical stimulation of the human cerebellum can cause a change in the EEG which may be either diffuse or localized and is not seemingly dependent upon stimulation of any particular area of the cerebellum nor influenced by the presence of a gaseous general anesthesia. The most common change is that of the production of high voltage slow waves, seemingly an accentuation of the normal alpha rhythm. Activation patterns were not noted. These changes are similar to those produced by space occupying lesions of the posterior fossa. The possible mechanisms involved in these changes are discussed.

106 pages. $2.00. Mic 58-4420

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POLITICAL SCIENCE, GENERAL

AN ANALYSIS OF DIFFERENTIAL VOTING PARTICIPATION IN THE 1953 DEMOCRATIC MAYORALTY PRIMARY ELECTION IN NEW YORK CITY

(Publication No. 24,976)

Israel Glasser, Ph.D.
New York University, 1957

The importance of the direct primary as an instrument for the selection of key party and government functionaries is generally recognized. However, little empirical research has gone into the identification of the factors which make for varying degrees of voter participation in primary elections.

This inquiry was an attempt to explain the variations in primary voting participation in a single primary election. A detailed examination was made of the relationships of selected socio-economic and political factors to the voting participation in the primary contest between the incumbent Mayor Vincent R. Impellitteri and Robert F. Wagner, Jr. for the Democratic nomination for Mayor of New York City in 1953.

The contest had its roots in the factional struggles for control of the Democratic Party and its component county organizations in New York City. Another aspect of the contest was the fight for dominance between the more liberal and conservative wings of the Democratic Party.

In this well-publicized campaign, Robert F. Wagner, Jr. sought support by identifying his candidacy with the fortunes of the New Deal-Fair Deal wing of the Democratic Party. He also concentrated on attacking the Mayor's record on several significant local issues. The campaign of Mayor Impellitteri consisted largely of a defense of his record in office, and a concerted attempt to enlist support among Negroes.

Analysis of the voting behavior in the primary revealed the apparent existence of two kinds of primary voters. There appeared to be a substantial segment of primary voters who evidenced greater interest in local district party politics (micro-political) than in the city-wide aspects of the primary contest. An even larger segment of primary voters, however, seemed to have been concerned with the macro-political, or city-wide, aspects of the Democratic primary election.

The micro-political primary voters appeared to be more prevalent in areas characterized by low income, low educational achievement, older housing units, low degrees of home ownership, strong consistent Democratic voting, and higher than average non-white populations.

The primary election voting behavior of the assembly districts was measured by two standards. The first was the number of actual Democratic primary voters in the 1953 contest as compared with the potential Democratic primary vote. The second was the degree to which the 1953 Democratic primary vote exceeded the "hard core" primary vote of the uncontested Democratic primary election held in previous years--a rough measure of the vulnerability of the local organized political strength.

Primary voting levels measured by both standards were highest in areas characterized by high incomes, high educational achievement, and greater concentrations of persons employed in the "higher" occupations. The reverse was true of districts with above average percentages of non-white populations.

Higher proportions of eligible primary voters were mobilized in the districts with greater percentages of female Democratic enrollments, histories of many recent contested Democratic primary elections and strong support of the Stevenson candidacy in 1952.

Areas with high turnover in residential populations appeared to be able to expand their primary voting participation over the minimal levels of the "hard core" vote more readily than the more stable areas.

No definitive relationships were established between primary voting levels and the community factors of recency of development, and the degree of home ownership. Nor was any significant relationship established between primary voting and age of population, Democratic enrollments, Democratic voting strength, or Democratic consistency in voting. 224 pages. $2.90. Mic 58-4421

THE ROLE OF THE MINORITY PARTY IN BIPARTISAN FOREIGN POLICY FORMULATION IN THE UNITED STATES, 1945-1955

(Publication No. 25,333)

Edward Riddle Padgett, Ph.D.
University of Maryland, 1957

Supervisor: Dr. Elmer Plischke

During the last decade bipartisan foreign policy has become part of the American concept of how foreign policy should be formulated. The purpose of this study is to analyze and evaluate the role of the minority or opposition party in the formulation of such policy.

Bipartisanship means the cooperation between the executive and both parties in the legislative branch of our government in the formulation of foreign policy. Such cooperation is achieved by frequent consultation between the President, the Secretary of State, and the ranking members of both political parties on the committees of the Congress concerned with foreign relations. In two cases in the last decade, the Congress has been controlled by an opposition party, a situation which creates special need for bipartisanship in foreign policy.

The principle of the separation of powers in the American constitutional system creates a difficulty in communication and also a natural rivalry between the two branches. Bipartisanship is an effort to overcome in the field of

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foreign affairs the harmful effects of partisan politics. The Congress of the United States cooperates with the President through its powerful standing committees in creating a national bipartisan policy representative of the whole country.

This national unity in foreign affairs can be achieved within the institutional framework which we call bipartisanship, in which the minority or opposition party plays a forceful role in foreign policy formulation. Many critics of bipartisanship feel that it creates a sense of harmony at the expense of full debate of major issues.

In six chapters devoted to case studies of bipartisan policy formulation it is demonstrated that the minority party plays a major role in the creation of foreign policy. In consummating the great postwar treaties, the Senate fulfilled its Constitutional functions of giving advice and consent. As this process is handled by the Foreign Relations Committee, its membership of both parties participates in policy-making. In such programs as foreign aid, the House of Representatives acts to authorize the appropriation of large sums to execute such policies.

In addition to their functions in the legislative process, members of the minority party participate in bipartisanship through appointment as delegates to leading international conferences and sessions of the United Nations General Assembly, and in extensive committee and subcommittee consultation with the Secretary of State and Department of State officials.

The effectiveness of bipartisanship depends as much upon the personalities involved and their prestige and ability as on the means of communication between the legislative and executive branches. As the control of both houses of the Congress in recent years has been held by slim majorities, bipartisanship is necessary to gain support for foreign policy. Most bipartisan measures in foreign policy have been enacted by large majorities in the Congress.

Bipartisanship has resulted in a centerist coalition to further a foreign policy worthy of a great world power. The opposition to such policy usually has come from extremists in both political parties. Those who speak for the minority party must be men of prestige who can be responsible spokesmen for their party such as Senator Arthur Vandenberg who dominated the decade. They must work in an atmosphere of mutual respect and trust with members of the executive branch.

Bipartisanship is therefore a means whereby the President can work with the Congress to create a truly national foreign policy which is removed from partisan politics. It is a typically American pragmatic solution to the problem of executive legislative-relationships. The executive branch consults and works with both the majority and minority parties in the Congress to fulfill our role as a major world power. 405 pages. $5.20. Mic 58-4422

DECISION-MAKING IN THE COMMITTEE ON RULES

(Publication No. 24,919)

James Arthur Robinson, Ph.D.
Northwestern University, 1957

The objects of this thesis are two. The first is to describe the role of the Committee on Rules as one of the structures for arranging and allocating time for the consideration of the legislative program of the House of Representatives. Like any political system, the House requires an internal organization of its time and resources. Approximately nine-tenths of the bills which the House considers are routine and non-controversial and most of these are disposed of by the Consent and Private calendars. Numerous measures are handled by unanimous consent and a few by suspending the rules or on District of Columbia day. Neither Calendar Wednesday nor the Discharge Calendar accounts for much legislative work. The remaining one-tenth of the House program is debated at length, and the Rules Committee is one of the structures which arranges for the consideration of a large number, although not all, of the controversial measures. By means of "rules" (formerly called special orders), the Committee proposes regulations to govern debate and amendment. These rules are called up after consulting the Speaker and Majority Leader and are almost invariably adopted by the House. (Only two proposed rules were defeated in the period studied, 1937-1956.) The Committee writes either open or closed rules (meaning that a bill is open to amendment or closed) which also stipulates the length of debate. Occasionally rules are reported waiving points of order against unprivileged provisions in otherwise privileged bills (e.g., appropriation bills) or governing matters relating to conference committees. This description is based upon a study of the resolutions reported by the Committee and pertinent debates on the House floor.

The second purpose is to explain the behavior of the Committee in terms of three clusters of variables borrowed from Richard C. Snyder's analysis of decision-making processes: competence, communication and information, and social backgrounds. Research, including interviews of all Committee members in the 85th Congress as well as the House Leadership, revealed that members are permitted to interpret rather freely their explicit competence or authority and that they are expected to exercise their own judgment in determining which bills should reach the floor as well as to consider the wishes of the Leadership. The major sources of the Committee's information are public hearings at which only congressmen usually testify, the Leadership, and informal meetings with individual congressmen. The Committee's staff and the White House are not important sources of information, interviews disclosed. A study of the social backgrounds of members may be summarized briefly. Their previous life experiences usually include several years of political activity before election to Congress, two or three terms on a committee of lesser prestige, and a record of cooperation with the party Leadership. Rural representatives from the South, East, and Midwest are most frequently appointed. As in the selection of decision-makers elsewhere in the political system, members are recruited from the upper strata of the nation's system of social stratification, especially with respect to educational

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attainment, occupational status, and religious affiliation. However, generalizations are lacking about the extent to which these various social backgrounds are relevant to explaining congressional voting behavior. The theoretical problem of scientific explanations of political behavior is treated briefly. Following a summary chapter which relates the author's findings to those of other students of the Committee, proposed reforms in the competence of the Committee and its role in House politics are considered and criticized. 297 pages. $3.80. Mic 58-4423

GOVERNMENT PROMOTION OF AIR TRANSPORT: 1925-1938

(Publication No. 23,881)

Paul D. Tillett, Ph.D.
Princeton University, 1957

During the period between World Wars I and II, every major nation attempted to create for itself a transport network utilizing the airplane which had figured so prominently in the 1914-1918 conflict. In the United States, initial federal efforts took the form of employing the airplane in the carriage of mail by a government-operated service. The Air Mail Service, 1918-1926, pioneered scheduled flying, night flying, use of radio, lighted airways, provision of timely weather data, flight procedure and traffic control. The project was undertaken in the expectation that success would stimulate private industry to take up the tasks of planning, financing and promoting air transport on a national scale.

After demonstrative experiments failed to attract investment, the federal government subsidized air transport through mail payments. President Hoover's Postmaster General attempted to lure reluctant air mail contractors into rapid expansion of passenger and express business by linking compensation to provision of such facilities. His policies favored large, strong companies.

A sterner course was chosen by the New Deal in a mood of economy and reform. Charges of favoritism and corruption led to cancellation of all domestic air mail contracts in 1934. Following a disastrous resort to the Army Air Corps as air mail carrier, New Deal policies, as embodied in the Air Mail Act of 1934, seemed calculated to compel the air carriers to pursue nonmail revenues aggressively or die.

In 1935 a Federal Aviation Commission, appointed by the President, condemned competition and advocated stabilization of routes and carriers and establishment of an independent regulatory commission for aviation. The President, however, expressed a desire to consolidate all transport regulation in the Interstate Commerce Commission. There the matter rested for several years.

The interregnum was characterized by bitter conflicts concerning proper interpretation of the Air Mail Act of 1934 and industry efforts to secure federal regulatory legislation. Air transport grew, effecting impressive reductions in airline dependence on subsidy.

Meanwhile, the President lost his enthusiasm for the Interstate Commerce Commission in part because of the Humphrey decision and the criticism of regulatory commissions by his own Committee on Administrative Management (Brownlow Committee). When advisers again pressed for permanent aviation legislation, he appointed an Inderdepartmental Committee.

The draft bill presented by that group closely resembled legislation avidly sought by the industry itself after 1934, providing for a new commission subject to presidential supervision in executive phases of its work. With some modifications the proposal became the Civil Aeronautics Act of 1938--a triumph for the industry by reason of its guarantee of permanent federal franchises for existing carriers and explicit assumption of a government obligation to support individual lines on the basis of "need."

The methods pursued by the federal government did not result in attracting large private investments in air transport; private funds were often used wastefully. Government support also fluctuated, bearing no consistent relation to established goals of public policy. Thus, partial failure was experienced in developing rapidly an air transport system adequate for commerce, national defense and air mail. Over the whole period, this appears to have been due to a lack of planning or adequate controls over the airlines. The New Deal, however, bears a special responsibility for failing to propose new policies during the cancellation episode. 368 pages. $4.70. Mic 58-4424

THE INDIAN CONSTITUTION AND THE HINDU TRADITION: THE CONFLICT OF BASIC POLITICAL VALUES

(Publication No. 24,931)

Vincent Cornelius Watson, Ph.D.
Northwestern University, 1957

Supervisor: William M. McGovern

The Problem

This study concerns the conflict of two value systems in contemporary India, the British-introduced western values of the middle class Indian elite and the indigenous tratitional values of the vast uneducated masses of the country. The aims of the study are to discover the origin of each of these two value systems, to identify their doctrinal content, and to compare them in order to isolate points of conflict which have implications for political and social behavior.

The Procedure

The origins of the two value systems are determined by an examination of their historical background. The polities which characterized the Maurya, Gupta and Mughal Dynasties are examined and contrasted with the polity produced during the two centuries of British rule in India. The Hindu, Muslim and British heritages are then compared to the republican polity established in the Constitution of 1950 in order to determine which had predominant influence in the structuring of the new order in India. The doctrinal content of the Hindu value system is identified through an examination of the literature of Hindu philosophy and anthropological, sociological and economic analyses of Indian society. The doctrinal content of the

Constitutional values is identified through a study of the Constitution itself and the debates of the Constituent Assembly. The doctrines of Hinduism and the Constitution are compared in behavioral terms in order to determine the points of essential conflict, particularly regarding government policy in the social and economic realms.

The Conclusions

This study yields a four-fold conclusion. First, the values of the Constitution are a product of the education of an Indian elite in western values during the last century of British rule. The values of this westernized elite are fundamentally of European origin, embracing the concepts of social, economic and political democracy. Second, the traditional Hindu values are derived from centuries of ethical speculation and modification in social practice. About 1,000 A. D. the traditional values were rigidified in order to prevent acculturation under the impact of Mughal and British rule, and that process of rigidification was compounded by the policy of the new rulers of enforcing the social status quo through the courts and legal system. Third, the values of the Constitution are fundamentally individualistic and democratic while those of Hinduism are collectivistic and rigidly hierarchical. Fourth, the policy of social and economic democratization being pursued in accord with the principles of the new Constitution is fundamentally antithetical and alien to the traditional social and economic patterns which dominate the Indian masses. Therefore it may be anticipated that the policy of democratization being pursued by the republican government of India will encounter serious barriers to success in the form of active or passive resistance by the tradition-bound masses. 385 pages. $4.95. Mic 58-4425

THE DOMESTIC POLICIES OF THE LIBERAL PARTY OF GREAT BRITAIN 1906-1914: THEIR EFFECT UPON THE FUTURE OF THE PARTY

(Publication No. 23,459)

Harold Webb, Jr., Ph.D.
Brown University, 1957

From the General Election of January 1906, to the outbreak of the First World War in August 1914, the last Liberal administrations to control the government of Great Britain in peace time held office. After the formation of the first War Coalition Government in 1915, the Liberal Party was never again to have sufficient electoral strength to form a Government. The spectacularly rapid demise of the Liberal Party presents one of the most interesting political phenomena of the Twentieth Century.

The Liberals were swept into office in 1906 with the greatest majority any political party had held in the House of Commons since the great Whig victory of 1832. A promise to continue a "Free Trade" fiscal policy was primarily responsible for this great Liberal triumph, but beyond this, there was little indication as to what the legislative program of the new Government would be. It was essential for the Liberal cause that the leaders of the party produce a progressive legislative program of social and economic reform at this time, for a new political force had arisen in Great Britain. This force was the newly created Labour Party, which looked to the trade unions and the working classes for its support. If the Liberals did not want to lose the support of these elements in the electorate, they would have to satisfy their demands, hopes and aspirations. This the Liberal Party failed to do during the years 1906 to 1914.

Beginning with the legislative session of 1906, the Liberal Government became involved in a constitutional struggle with the Conservative dominated House of Lords that was to last for five years. Preoccupied with this dispute, the Liberal Government postponed, or neglected altogether, the needs of the working classes. In the attempt to build up a case against the Lords, bills were introduced that lacked national appeal and consumed an inordinate amount of Parliamentary time. When this constitutional crisis was finally settled, by the passage of the Parliament Act in 1911, the Liberals were entangled in the debacle over Home Rule for Ireland. The Government's inaction and blunders with respect to Ireland, brought that nation to the brink of civil war, and threatened to break down constitutional government in Great Britain.

While engaged in this constitutional struggle, the Liberals lost contact with the trade unions and working classes. Though trade prospered through most of this period, wages failed to keep pace with the rising cost of living. Dissatisfied with their economic status, the workers participated in a wave of strikes beginning in 1910 that threatened to disrupt the nation's economic life. By 1914, a combination of large trade unions posed the greatest labor problem that any English government had ever faced.

The Liberal legislative program had failed to recognize the needs of a changing world. Working class voters wearied of waiting for Liberal reform. Trade unions that had been affiliated with the Liberal Party in 1906 were, by 1914, affiliated with the Labour Party. The loss of this Support meant the end of the Liberal Party.

248 pages. $3.20. Mic 58-4426

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

GERMAN LEBENSRAUM POLICY IN EASTERN EUROPE DURING WORLD WAR II

(Publication No. 25,236)

Ihor Kamenetsky, Ph.D.
University of Illinois, 1957

One of the essential features of Nazi ideology and foreign policy was the political domination of Europe and territorial expansion towards Eastern Europe, which was supposed to become a German "living space".

Both objectives were prerequisites for the creation of a huge, stable, and permanent Germanic Empire, which Hitler predicted would last a thousand years. In this scheme the whole of Eastern Europe, reaching as far as the Ural Mountains and inhabited by such "inferior" peoples as Poles, Czechs, Ukrainians, Balts, Russians, and Byelorussians, had to be prepared for a large-scale Germanic colonization.

The present study analyses first the background of Nazi ideology and the blueprints for expansion and the links with past German political experience. It traces the building of powerful machinery for Lebensraum, a process which continued from the Nazi seizure of power to the years of war. It describes the Nazi Lebensraum Machinery in action, guided by the omni-potent SS-Organization. The grand design for the creation of a Eastern Germanic Empire from scratch, applying methods free from any traditional inhibitions and based on pseudo-scientific Nazi principles, is analysed and evaluated.

Specifically the study deals with Nazi practices and projects for colonization, Germanization, enslavement, and finally annihilation. It investigates the ways in which this policy affected the different peoples and races of Eastern Europe and their ultimate fate within the Germanic Racial Empire.

On the basis of the relevant Nazi documents, the most significant of which are included in the appendices, the thesis leads to the following conclusions:

(1) That the objectives of Nazi ideology and the early build up of the Lebensraum Machinery, aimed at an territorial expansion, made peaceful coexistance of the Nazi State with the other powers impossible.

(2) That ultimate Nazi victory in the East would result not only in ruthless and complete annihilation of the Jewish minority there, but would also result in the extermination or deportation of the most of Slaves inhabiting the territory designed as German Lebensraum.

(3) That from the unprecedented Nazi designs and practices there emanates a new pattern of a totalitarian imperialism. Unlike earlier kinds of imperialism it does not aim merely at economic exploitation, political or military control, of an alien people but tries to build a completely new society and a new order in the conquered territories and moves towards this goal with a revolutionary impetus and in fulfillment of a clearly outlined and rigidly constructed ideological frame.

272 pages. $3.50. Mic 58-4427

AMERICAN FAR EASTERN POLICY IN 1937

(Publication No. 23,454)

Otis Hung-i Shao, Ph.D.
Brown University, 1957

The purpose of this study is to deal with the events in the Far East in the 1930's leading up to the Sino-Japanese conflict in 1937 and the crisis itself, seeking to answer the following questions: (1) How was the traditional American Far Eastern policy understood and applied by the Roosevelt Administration during this period?; (2) What changes in meaning or application were made in it in the face of a challenge of unprecedented dimension?; (3) What were the principal contending interpretations and recommendations among men influential in policy-making?; (4) What lessons or conclusions can be drawn from observing this passage in United States diplomacy?

For the period prior to the 1930's standard histories have been used. For the developing crisis from 1931 onward the volumes of the Foreign Relations series for the several years; the White House Papers; the records of the International Military Tribunal for the Far East; and the private correspondence of Ambassador Nelson T. Johnson have been examined. The published memoirs of and conversations with people who possess special knowledge or who had a part in these events have thrown light on some dark places.

The more important findings include the following: Japanese expansion into North China since 1933 had been premeditated and systematic, developing into the Marco Polo Bridge Incident of July 7, 1937. The Incident and the developing crisis brought the United States face to face with the Far Eastern issue. To meet this challenge the Roosevelt Administration was unwilling to depart from the traditional approach of avoiding any commitment to associate with other powers in collective action. The decision not to answer the Japanese challenge by international action was apparently due to the reinforcement by pressing domestic problems of the desire of the American people not to be drawn into a foreign war; realization that military preparation was inadequate; and the cautious recommendations of the professionals, notably Hull, Hornbeck, Grew and Johnson. To these must be added the lack of executive leadership. Sumner Welles' plan for peace and Norman Davis' recommendations for a more active program were not carried out.

But Roosevelt, chiefly on his own initiative, did indicate a desire for international cooperation. His "Quarantine" statement was a bold suggestion of international action for it envisioned an international agreement to apply diplomatic sanctions against the aggressors. But it lacked the necessary preparations before and consistent follow-up after the event. The Welles plan which had caught the imagination of the President could have become a step in the direction of international action. The Brussels Conference was doomed to failure at the outset because of the President's determination not to consider any active program. He and his Secretary staked the whole case on the force of moral suasion but made it impossible to mobilize public opinion. Thus by applying the traditional approach to a new situation in the Far East the American Government allowed Japanese aggression to spread. This led directly to Pearl Harbor.

These are the lessons suggested by this study: First of all, it is clear that mere words and empty formulae will not suffice to stop or even seriously hinder a determined aggressor. Secondly, it is plain that the best time to stop a war is before it begins--before a country or a group of nations becomes so involved that it cannot withdraw without suffering a serious loss of face.

347 pages. $4.45. Mic 58-4428

PSYCHOLOGY, GENERAL

ANXIETY IN ACADEMIC ACHIEVEMENT SITUATIONS: ITS MEASUREMENT AND RELATION TO APTITUDE

(Publication No. 25,365)

Richard Alpert, Ph.D.
Stanford University, 1957

This present research was undertaken in order to appraise the adequacy of several questionnaire-type scales currently being used for the measurement of anxiety in academic testing situations, and to develop additional scales which might increase prediction of anxiety in these situations. Both the evaluation of existing scales and construction of new scales were based on a theoretical response model for the operation of anxiety in academic performance.

Procedurally, this research involved the administration of a variety of anxiety scales to the subjects either in their classes, or in small group experiments in which they participated in order to fulfill a class requirement that they serve as subjects in psychological experimentation. The anxiety scales which were administered included: the Taylor Manifest Anxiety Scale, the Welsh Anxiety Index, the Freeman Anxiety Scale, the Mandler-Sarason Test Anxiety Scale, and the plus and minus subscales of a new scale, the Achievement Anxiety Scale. The first three were grouped as instruments for the measurement of general anxiety, i.e., instruments having items referring to a variety of anxiety situations. The remainder of the scales were categorized as specific anxiety scales, i.e., scales having items specific to the academic testing situation. The analyses of the data involved intercorrelating these scales, and studying the relationship of these scales to a measure of verbal aptitude and to a set of academic performance indices including college grade-point average; and final examination, midterm examination and course grades in the introductory psychology course.

The subjects used in this study, with the exception of one group composed entirely of entering college freshmen, were drawn from the male population of the introductory psychology course at Stanford University.

The results of the research support the following conclusions:

1. Specific anxiety scales, and general anxiety scales are measuring, to a significant extent, something different from one another.
2. The specific anxiety scales are better predictors of academic performance than are the general anxiety scales.
3. The general anxiety scales are not significantly related to verbal aptitude while the specific anxiety scales are all related to aptitude with correlations whose p values reach at least the .02 level of significance.
4. The specific anxiety scales although more highly correlated with aptitude than the general anxiety scales are nevertheless more often than the general anxiety scales able to account for variance in academic performance other than that accounted for by a measure of aptitude.
5. The data presented fail to support an explanation of the relationship between anxiety scales and measures of aptitude which is based on the use of the anxiety scales as vehicles for rationalization or justification by students with poor past performance in academic situations.
6. These data are unable to either support or reject an explanation of the relationship between anxiety scales and measures of aptitude which is based on the assumption that aptitude test scores are, themselves, affected by anxiety. A possible experiment that we believe would clarify this issue is suggested.
7. The data presented fail to provide any evidence which would indicate that the incorporation of items designed to measure facilitating anxiety into a scale which already effectively measures debilitating anxiety significantly increases the prediction of academic performance scores.

These conclusions support in general the continued use of a specific measure as a beneficial supplement to aptitude measures in the prediction of academic performance. Furthermore they clearly suggested that further use of a general anxiety scale rather than a specific anxiety scales as an appropriate operation for the measurement of academic achievement is unwarranted.

86 pages. $2.00. Mic 58-4429

SOME RELATIONSHIPS BETWEEN GROUP STRUCTURE AND DISCUSSION BEHAVIOR

(Publication No. 25,325)

Irwin Altman, Ph.D.
University of Maryland, 1957

Supervisor: Associate Professor Elliott McGinnies

This study investigated certain aspects of discussion behavior in groups of varied member composition by means of a series of low inference response measures. An attempt was also made to determine the generality of some broad theoretical hypotheses treating communication in small groups.

A modified form of the California Ethnocentrism (E) scale was administered to a large number of high school students. On the basis of their scores, one hundred fifty

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individuals were selected for the experimental sample. Half the students had scores indicating favorable attitudes toward a number of ethnic groups (low Es), while the others expressed prejudiced attitudes (high Es). High and low Es were assigned to five structure conditions for the purpose of viewing and discussing a film dealing with the topic of prejudice. The structure conditions were: high E homogeneous, high E majority, high E-low E equality, low E majority, and low E homogeneous. Each structure condition was replicated five times, yielding a total of twenty-five discussion groups. Following each discussion, Ss were readministered the E-scale in addition to a questionnaire containing group cohesion, issue relevance, perceived consensus of opinion, and sociometric choice items.

The discussion indices employed were: spontaneity or the degree of participants' independence from leader stimulation, rate of response or the activity level of discussions, direction of response or the flow of interactions between group members, and spread of participation or the relative equality of participants' contributions to discussions.

The most suggestive evidence concerning the effects of group structure on discussion behavior arose in the case of the balanced groups. Here, spontaneity and rate of response were lowest compared to the other structures. Although heterogeneous groups were more active than homogeneous groups, an analysis according to attitudinal predisposition showed no difference for high Es. The interaction between group structure and attitude was also demonstrated by the finding that high Es were more spontaneous in the majority position compared to the minority one, while the reverse held for low Es. In addition, low Es increased their interactions toward the opposition and became more equal in their contributions as they progressed toward the minority position. High Es exhibited the reverse trend.

High and low Es both changed their attitudes in the direction advocated by the film. However, attitude change was shown to be greater in the heterogeneous groups for both predisposition groups. Finally, there was some indication that the magnitude of attitude change increased for high and low Es as they progressed toward minority positions.

An analysis of questionnaire responses showed lower cohesion and less accuracy in perceived consensus of opinion in the balanced groups. Subjects in the balanced condition also tended to feel more compatible with persons holding dissimilar attitudes as compared with the other structure conditions. In addition, high Es were less perceptive of the distribution of opinions in all groups and less apt to prefer like-attitude individuals than low Es.

The results were interpreted as demonstrating the usefulness of the response measures employed. The findings also suggest the necessity of considering group structure and its interaction with attitude predisposition in describing group behavior. 156 pages. $2.05. Mic 58-4430

QUALITIES NECESSARY FOR SUCCESS AS AN ARMY OFFICER - AN OBVERSE FACTOR ANALYSIS OF OFFICER OPINION

(Publication No. 24,090)

Joel Tillman Campbell, Jr., Ph.D.
The Ohio State University, 1952

The study was designed to investigate clustering of opinion on desirable qualities for Army officers. The procedure employed was an adaptation of the Wherry-Gaylord iterative factor analysis procedure[1] to an obverse factor problem,[2] that of finding whether different groups of Army officers emphasized different clusters of traits as necessary to officer success.

The data analyzed were responses by 259 Army officers to a check list of behavior or characteristics pertinent to Army officers. Their responses indicated whether they considered each item to be a desirable or undesirable criterion for selecting an officer for promotion.[3]

Three bi-polar factors were extracted. These factors were identified as loyalty and ability, personality and job attitude, and interpersonal relations.

These factors were compared with those found by Wherry, Campbell, and Perloff[4] in a previous study. In that study, a factor analysis was performed on the same items when the items had been used to rate particular officers. Four factors were found which were identified as proper attitude toward the job, successful interpersonal relations, forceful leadership and initiative, and job competence and performance. Three of these "rating of persons" factors have counterparts with "desirable qualities" factors.

"Forceful leadership and initiative" did not appear as a factor in considering "desirable qualities." It is hypothesized that there is sufficient uniformity concerning the importance of leadership among the various groups to make it unnecessary that it appear as a factor.

Conversely, the "proper attitude toward the job" factor found in "rating of persons" did not have the strong "loyalty" component found in the "desirable qualities" analysis. It is hypothesized that since Army officers by and large are loyal, this factor will not appear in a rating of persons study but does appear when officers are asked to assess the importance of various traits.

The three groups were not differentiated by grade or by branch assignment. Apparently, such differences of opinion as do exist regarding the qualities necessary for a successful officer are not split along grade and branch lines.

The results obtained substantiated two hypotheses:

1. The Wherry-Gaylord iterative factor analysis procedure is adaptable to the obverse factor problem in those cases where a large number of persons are to be factored.
2. Some support is given to Burt's reciprocity hypothesis[5] inasmuch as the results of two different kinds of factor analysis of two similar but not identical instruments are very similar. 70 pages. $2.00. Mic 58-4431

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2. Stephenson, W. "The Inverted Factor Technique," Brit. J. of Psych., 26 (1936), pp. 344-61.

3. Staff, Personnel Research Section. "Determination of Preference and Discrimination Values of Phrases for Preference Check List Sections of Alternate Forms of Officer Efficienty Report WDAGO Form 67-1," PRS Report No. 846.

4. Wherry, R.J., Campbell, J. T., and Perloff, R. "An Empirical Verification of the Wherry-Gaylord Factor Analysis Procedure," Psychometrika, 16 (1951), pp. 67-74.

5. Burt, C., and Stephenson, W. "Alternative Views on Correlations Between Persons," Psychometrike, 4 (1939), pp. 269-82.

Abstract published by special arrangement with The Ohio State University.

THE EFFECTS ON FANTASY OF ACHIEVEMENT MOTIVATION BASED ON "FEAR OF FAILURE" AND "HOPE OF SUCCESS"

(Publication No. 23,597)

Harvey L. Glass, Ph.D.
University of Pennsylvania, 1957

Supervisor: Seymour Feshback, Ph.D.

It was the purpose of the present study to investigate the effects of experimentally induced "hope of success" and "fear of failure" upon the expression of achievement imagery in fantasy as sampled by the Thematic Apperception Test. Pursuing the theory that the former kind of achievement motivation led to the appearance of instrumental goal responses in fantasy while the latter led to irrelevant responses, the following hypotheses were formulated:

Achievement motivation based on "hope of success" will result in significantly more achievement fantasy than achievement motivation based on "fear of failure."

An increase in drive level will result in a significant increase in achievement fantasy when the achievement motive is based on "hope of success", but an increase in drive level will result in a significant decrease in achievement fantasy when the achievement motive is based on "fear of failure."

Because of the possibility of the measure of motivation not responding to arousal of motivation in the "fear of failure" conditions, the Discomfort-Relief Quotient was utilized as a measure of general tension not dependent on the scoring of achievement imagery and the following hypothesis was proposed:

Under both "hope of success" and "fear of failure" conditions, increases in drive level will result in significant increases in a general measure of tension based on verbalizations on the Thematic Apperception Test.

The subjects were 96 undergraduate college men assigned randomly to either "hope of success" or "fear of failure" conditions under either high or low drive level conditions. All subjects were administered the Mandler-Sarason Scale of Test Anxiety at the time they volunteered to participate. Motivation was aroused through verbal instructions which were implemented by requiring the subjects to perform a modified digit-symbol substitution task and an anagrams problem. The dependent variables were n achievement scores based on TAT protocols, task performance scores, self-ratings of anxiety following the experiment, and DRQ scores.

The following results were obtained:

The first experimental hypothesis was not supported by the data. Because the instructions for varying the level of drive were ineffective, the second hypothesis was not tested. No evidence was found for the validity of the DRQ and, as a consequence, the third hypothesis was not tested. Evidence was obtained that instructions designed to induce "hope of success" and "fear of failure" were effective, since:

a. "Fear of failure" conditions resulted in disruption of performance on relatively complex task;

b. "Fear of failure" conditions resulted in higher self-ratings of anxiety than did "hope of success" conditions; and

c. "Fear of failure" conditions resulted in higher n achievement scores in subjects who were initially anxious about taking tests than did "hope of success" conditions, while "fear of failure" conditions resulted in lower n achievement scores in subjects who were initially non-anxious about taking tests than did "hope of success" conditions.

The following conclusions have been drawn: the first hypothesis, that "hope of success" achievement orientation will result in the production of more achievement imagery in fantasy than will "fear of failure" orientation, is not tenable. The experimental results indicate that the effect of these conditions on achievement imagery depends on whether the subjects are or are not initially anxious about competing on intelligence tests. "Hope of success" conditions did not engage achievement motivation in high anxious subjects and "fear of failure" conditions failed to engage motivation in non-anxious subjects. There was no evidence of inhibition of achievement imagery in highly anxious subjects under "fear of failure" conditions. Rather, achievement strivings in subjects who are anxious about taking tests are elicited by instructions that heighten the possibility of failure while achievement striving in non-anxious subjects is engaged by conditions which emphasize the possibility of success.

49 pages. $2.00. Mic 58-4432

THE BASIS OF SOLUTION BY PREVERBAL CHILDREN OF THE INTERMEDIATE SIZE PROBLEM

(Publication No. 25,330)

Richard C. Gonzalez, Ph.D.
University of Maryland, 1957

Supervisors: Dr. Sherman Ross and Dr. C. N. Cofer

This study was designed to determine the factors limiting the range of transposition in preverbal children while testing Spence's theory of discrimination learning. Spence's theory can account for the "distance effect" in two-choice discrimination problems, but in the case of intermediate size problems it permits no transposition at all. Recent studies have shown that the intermediate size problem can be transposed thus casting doubt on the

adequacy of Spence's theory. However, in these studies preverbal subjects transposed to near test sets but not to far ones. Since these results cannot be accounted for by Spence's theory the distance effect is left unaccounted for.

The hypotheses advanced in this thesis were that the range of transposition (and thus the distance effect) is limited by the range of stimulus equivalence and that preverbal subjects can solve intermediate size problems in relational terms. In order to test these hypotheses the subjects in the experimental group were given relationally congruent pretraining on two widely separated sets of three stimuli and then tested for transposition with a new set lying between the training sets, but far removed from each. The intermediate size stimulus was reinforced in both sets during training. The same procedure was used for the control group except that here reinforcement was relationally contradictory, i.e., the smallest stimulus in one training set and the largest in the other were reinforced. For both groups, reinforcement in training took place at points symmetrical about the test set. Thirty-one preverbal nursery children were used as subjects.

The results supported the hypotheses advanced in this thesis and contradicted the theoretical position advanced by Spence. The experimental group transposed the intermediate size solution beyond the .01 level of confidence. Thus, under these experimental conditions which provided for the test set to be within the range of stimulus equivalence with the training set, the distance effect did not take place. The control group chose the intermediate size stimulus in the test set fewer times than expected by chance thus ruling out the possibility that the transposition behavior of the experimental group was due to the symmetrical reinforcement received in training. These results cannot be accounted for in terms of components. It was concluded that they point to the operation of a relational process in the solution of intermediate size problems by preverbal children. It was further concluded that it is no longer necessary to assume that verbal and preverbal subjects necessarily function on a qualitatively distinct level in solving discrimination problems.

51 pages. $2.00. Mic 58-4433

INVESTIGATIONS OF SENSORY INTERACTION

(Publication No. 24,162)

Kay Inaba, Ph.D.
Purdue University, 1957

Major Professor: J. Tiffin

The problem under investigation was the determination of the effects of auditory stimulations on visual perception. Two aspects of the problem were studied: (1) the differential effect, on visual acuity, of different tonal stimulations, and (2) the effect of an auditory stimulation on perceptual learning. More specifically, whether perceptual learning would be facilitated or inhibited when the task is accompanied by tonal stimulations. Part I of the study is concerned with the first aspect of the problem, and Part II with the latter aspect.

Two experiments were conducted in Part I. An 8 x 8 modified Latin Square with groups assigned to rows was used in experiment I. Eight levels of the intensity and frequency of the tones were used, and each subject was given eight combinations of the two variables. Four subjects were randomly assigned to each group. The criterion measure was made with Landoldt rings, with thresholds being determined by the method of constant stimuli. The sound preceded the target by 0.5 sec. and the duration of simultaneous presentation was 1.5 seconds.

The analysis of variance revealed only an intensity by frequency interaction for between groups. A simple effects test revealed this difference to be due primarily to the 40 db level of intensity and the 8192 cps frequency.

The procedure for experiment II was identical to that of experiment I, with the exception that a 3 x 3 factorial was used as the design. The variables were the intensity and the frequency of the tones, and the levels were chosen in accordance with the results of experiment I. No significant differences were found. The only conclusion that can be drawn from the two studies is that under the experimental conditions sensory interaction does not exist.

Four experiments were conducted in Part II. For all experiments, the criterion measure was the number of correct responses to a single Landoldt ring, selected separately for each subject. The targets were presented for only 0.1 second. For experiments III, IV, and V, 450 presentations were given in one hour. Nine hundred presentations in two one-hour periods were given in experiment VI.

The 450 presentations in a one-hour period was divided into three sets of 150 successive presentations, and the sets were further divided into three trials of 50 successive presentations. The scores were the number of correct judgments per trial.

No sound was given in experiment III. In experiment IV, the sound was presented only during the presentation of the target during the second set. In experiments V and VI, the sound was continuous for the entire set, whenever sound was present. In experiment V the continuous sound was presented during set 2. The experimental design for experiments III, IV, and V was a 3 x 3 factorial. The analyses of variance and the Duncan-Bonnor test between pairs of means in the three experiments indicate that perceptual learning took place and that this was facilitated by continuous sound but not by intermittent sound.

Five groups of subjects were used in experiment VI, and the groups differed in when the sound was introduced. Group 1 received sound during the third set, group 2 during the second set, and group 3 during set 1. Group 4 received sound during all presentations, and group 5 did not receive any sound. Measurements were taken on two separate days.

The following conclusions appear to be warranted from the analysis of variance and the Duncan-Bonnor tests made of the data:

1. An improvement of perceptual judgments with practice occurs even without any knowledge of results.
2. A loud sound, when presented during the entire course of learning, will not inhibit learning but in fact may increase the speed of learning.
3. A loud sound introduced in the early stages of learning will increase the speed of learning, but not necessarily the quantity of learning.
4. A loud sound introduced after a certain amount of improvement has taken place tends to inhibit retention.

119 pages. $2.00. Mic 58-4434

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A STUDY OF JOB RELATED VALUES OF INDUSTRIAL MANAGERS

(Publication No. 24,164)

Donald C. King, Ph.D.
Purdue University, 1957

Major Professor: C. H. Lawshe

This thesis represents an attempt to assess the job related value systems of managerial men and to relate the results obtained to problems of managerial motivation.

Eighty-seven managerial men in a midwestern farm tractor manufacturing plant completed an open-end questionnaire in which they were asked to list the ways in which they felt their job was better than their subordinates' jobs and their immediate supervisor's job. The men were also asked to list the ways in which they felt their subordinates' jobs and their immediate supervisor's job were better than theirs.

The 1033 responses to this questionnaire were theme-analyzed and 25 response themes were developed. Coefficients of overlap between all of the 25 themes were computed and the resulting matrix of intercorrelations was subjected to cluster analysis.

On the basis of the theme analysis, the number of men who mentioned each theme, and the cluster analysis, a list of 18 valued job characteristics was developed and prepared for paired-comparison administration.

A total of 327 men, approximately 90 per cent of the managerial force, participated in the paired-comparison of the 18 valued job characteristics. Three general types of analyses were made of the data obtained in this paired-comparison phase of the study.

First, the average preference of all the men for each of the 18 job characteristics was determined, then differences in patterns of expressed preferences were assessed for groups of men who differed in level of job held, type of job, age, scores on the Army General Classification Test, and, in the case of production foremen, in rated job performance.

Second, the significance of differences in the average consistence of responses was determined for men in different classifications for the variables just listed.

Third, measurements of the stability of expressed preferences were determined for three samples of men. One group of 34 men made a second paired-comparison of the 18 job characteristics on the same day as their first paired-comparison. A second group of 28 men made their second paired-comparison approximately 30 days after their first, while the third group of 30 men had approximately 60 days intervening between their two paired-comparisons. Average coefficients of stability for these three groups were .91, .86, and .78 respectively.

On the basis of the results obtained in this study the following statements appear to be justified:

1. Four clusters of characteristics wanted in a job were expressed by management men: desire for mobility and self-realization, desire for fixed personal expectancies or lack of threat, desire to direct and lead people, and desire to work without entanglements with individuals or social institutions.

2. When preferences were viewed for the total group, there were marked differences in average preference for various desired characteristics of jobs, but individual deviations from this overall pattern of preferences were the rule rather than the exception.

3. There was some evidence which indicated that men performing more satisfactorily on their jobs were better able to state consistently the characteristics which they wanted in their jobs than were men whose job performance was less satisfactory.

4. Systematically thinking about job values tended to result in at least a temporary increase in the consistence of men's thoughts about the characteristics that they desired in their jobs.

5. Traditional motivational theory can adequately explain the obtained differences in expressed preferences for job characteristics concerned with working conditions, physical demands of the job, or job security.

6. Traditional motivational theory does not adequately account for the obtained differences in expressed preferences for job characteristics related to the "higher order" needs, such as prestige and self-realization. In order to account for these differences a theory of motivation is needed which places more emphasis on the great multiplicity of possible avenues for the satisfaction of "higher order" needs. Such a theory should also provide for the possibility of greater desire for activities found to be means of satisfying such needs after such activities have provided partial satisfaction of these needs.

113 pages. $2.00. Mic 58-4435

THE EFFECT OF DIFFERENTIAL SOCIO-ECONOMIC STATUS UPON THE DEVELOPMENT OF CONCEPTUAL ABILITY

(Publication No. 21,769)

Jerome Siller, Ph.D.
New York University, 1957

Adviser: J. V. Hanna

Statement of Problem:

Socio-economic status was related to cognitive functioning which was specifically restricted to conceptualization. Two aspects of conceptualization were judged to be of greatest relevance for possible status differences: form of symbolism, by means of which conceptual ability is tested (verbal or non-verbal), and proneness to abstract. The basic problem was to determine whether status differences were a function of these two variables.

Procedure:

1. The subjects were 181 white sixth grade public school children. They were divided into high status (HS) and low status (LS) groups. There were 99 HS subjects and 82 LS subjects. Status was defined primarily from free lunch data and a modification of the Warner ISC.
2. An attitude and four conceptual tests were group administered to the subjects. The tests were verbal and non-verbal classification, verbal and non-verbal analogies, the LINE perceptual test, Abstract-Concrete Similarities, and a Measure of Status Orientation. 3. Statistical analysis was primarily by non-parametric devices such as the chi square, sign, and median tests. Group status comparisons were made on the basis of total groups and when Ss

from each status were matched on one test and compared on another.

Findings and Conclusions:

1. HS children did better than LS children on all tests of conceptual ability. 2. Greatest status differences were found on verbal material. 3. HS subjects, as a group, tended to respond in a more abstract manner than did LS subjects. 4. HS subjects matched with LS subjects on the basis of non-verbal scores and compared on verbal tests dealing with the same kind of conceptualization did better than the LS subjects. 5. LS subjects did not do better than HS subjects when the two groups were matched on verbal scores and compared on non-verbal tests dealing with the same kind of conceptualization. This finding meant that an interpretation in terms of hierarchical development of concepts, which would be favored by proponents of innate group differences, could not be ruled out. 6. It was felt that the dimensions of form of symbolism and "proneness toward abstraction" are sufficient to define two of the major reasons for status differences on conceptual tests. Motivational factors could not be investigated. 7. The attitude test was not successful in differentiating between the status groups. This was probably a function of the inadequacy of the test, although it is possible that the populations do not differ in respect to the items used. 8. The IQ and reading grade level of the HS group is significantly higher than that of the LS group. Ss were matched on IQ; there were no significant differences when they were compared on the conceptual tests. 9. The matched groups usually excluded low scoring subjects in the LS group and high scoring subjects in the HS group. These individuals were called the "one-tailed status extremes." 10. Two conclusions stem from these data. Firstly there is considerable overlapping between the two groups. Secondly those differences which do occur are a function of a relatively small group of subjects in the LS group. These subjects were termed "low" scorers as they were in the bottom quarter of their group on three or more of the tests. When these subjects were removed from the group (they were all LS), there were no status differences. 11. The meaning of the "low" scorer group was discussed in terms of innate vs. developmental causes and further study was strongly suggested. 128 pages. $2.00. Mic 58-4436

PERSONALITY FACTORS IN THE SELECTION OF JOB DUTIES

(Publication No. 25,341)

Richard Patrick Walsh, Ph.D.
University of Maryland, 1957

Supervisor: Professor John W. Gustad

The purpose of this thesis was to examine the relationship between psychological needs and job duty preference. To achieve this goal, the Job Description Questionnaire was employed. This was constructed by selecting specific job duties and/or working conditions from (a) the Dictionary of Occupational Titles; (b) actual job descriptions; and, (c) the investigator's own experience with the world of work. These items were then submitted to twelve clinical psychologists for classification into eight need categories--Achievement, Affiliation, Autonomy, Change, Nurturance, Exhibition, Dominance, and Order, and one other category entitled "none of these". Items on which ten of the twelve judges agreed were retained for the Questionnaire. From these items, eight were selected for each of the eight scales. To increase the length of the instrument, each item was repeated three times, each time in a different context. The actual format of the Job Description Questionnaire consisted of twenty-four fictional job descriptions, each on a separate page, and each having a representative item for each of the eight need scales.

The Questionnaire was then given to 96 undergraduate male college students who were asked to assume that they were members of an industrial consulting firm, hired to "sell" certain jobs to applicants. They were asked to select, in each job description, two duties and/or conditions they felt would appeal to most persons and the two they felt would appeal least. After completing the Questionnaire, they were given the Edwards Personal Preference Schedule which was constructed to measure the same needs as those selected for the Job Description Questionnaire.

Two hypotheses were proposed: (a) that a significant relationship exists between an individual's psychological needs and his preference for job duties and/or working conditions, and (b) that individuals will respond to different features of the same job on the basis of their psychological needs.

The analysis of the data clearly supported the first hypothesis in two ways: (a) individuals tended to group together duties in a manner consonant with the clinical judges, and (b) significant correlations were obtained between need scores obtained on the Job Description Questionnaire and the Edwards Schedule. Hypothesis II was considered to be only partially confirmed in that the group was too homogeneous in regard to the needs measured to produce enough variability in scores to conclusively test the hypothesis.

The results of this thesis offer the following implications: (a) psychological needs may be satisfied or frustrated by the job duties an individual is called upon to perform; (b) an individual may change his job to satisfy certain needs and avoid frustration of others; (c) there is a need for job analyses in terms of personality factors required for a given job; and, (d) study of a person's likes and dislikes in regard to job duties and/or working conditions offers another channel by which psychologists may study the motivations of human behavior.

68 pages. $2.00. Mic 58-4437

THE EXPRESSION OF GUILT IN FANTASY AND REALITY

(Publication No. 25,399)

Kenneth Robert Wurtz, Ph.D.
Stanford University, 1957

The purpose of the study was to determine the influence of a guilt-arousing experience upon the fantasy responses of nursery school children and to relate measures of guilt derived from a fantasy situation with measures derived from a real life situation.

Thirty eight nursery school children ranging in age from 3 years 10 months to 5 years 5 months were divided equally into an experimental group and a control group. All subjects were administered a standard 20 minute doll play session to establish rapport. After several days the subjects were given a pre-test and a post-test consisting of 6 matched pairs of incomplete doll play stories. All of the stories involved deviations on the part of the child doll similar in sex to the subject. Following the pre-test period the experimental group underwent a guilt-arousing experience and the control group did not. The guilt-arousing experience was the collapsing of a doll house with which the child was playing. Three of the matched pairs of stories were similar to the guilt-arousing situation and three were different from it. The completions of the stories and the immediate responses to the collapsable doll house were categorized and recorded.

Hypotheses were (a) that the guilt-arousing situation would produce an increase in the guilt responses of the experimental subjects to the doll play stories, (b) that this increase would be greatest in the stories similar to the guilt-arousing situation and least in the stories different from the guilt-arousing situation, and (c) that there would be positive relationships between measures of guilt based upon the story completions and measures of guilt based upon behavior evoked by the guilt-arousing situation.

The results failed to confirm any of the hypotheses. The experimental group tended to show a greater increase in refusing to complete stories and more response change from the pre-test to the post-test than the control group. Further analysis showed that the difference in total response change was primarily due to the high guilt children in the experimental group. These results proved that the guilt-arousing situation upset the children, and that high guilt children were more upset and disorganized by the situation than low guilt children.

The incomplete doll play story as used in this study tends to elicit sterotyped socially acceptable responses. High reliability was limited to a narrow range of responses dealing with punishment and fixing. It was concluded that this technique is too highly structured to allow the freedom of expression needed for fantasy responses.

79 pages. $2.00. Mic 58-4438

PSYCHOLOGY, CLINICAL

A PSYCHOLOGICAL EVALUATION OF CERTAIN ASPECTS OF ELECTRO-CONVULSIVE THERAPY

(Publication No. 24,495)

H. Robert Albrecht, Ph.D.
The Ohio State University, 1951

The study was conducted in order to investigate some of the effects of various temporal relationships between electroshock therapy and individual psychotherapy. Of particular interest in the investigation were the changes in the characteristics of psychotherapeutic interviews conducted under differing conditions of EST. Some of the practical questions which arose were: What combinations of EST and individual psychotherapy would be most effective? Could criteria for termination of EST be developed? Could predictions for prognosis following termination of EST be made?

The Method of Interview Analysis

Three scoring methods were used to analyze material produced during interview situations. These were the Thought Unit Index, which measures ideational productivity; the Efficiency Index, which indicates the quality of verbal materials; and the Global Rating, which indicates the subject's accessibility for psychotherapy.

Reliability studies were conducted in order to determine the usefulness of these scoring methods. It was found that trained judges were able to identify the scoring variables satisfactorily. The degree of concurrence between judges' ratings exceeded chance expectancy for all three scoring measures. Thus it was concluded that the method of analysis was a statistically reliable measuring device.

Subjects

The subjects used in this investigation were male veterans of World War II who were hospitalized at a Veterans Administration Neuropsychiatric Hospital. They were selected on the following bases:

1. They were diagnosed as psychotic without evidence of organic brain damage. Certain diagnostic groups were excluded because of evidence that there are differential reactions to EST displayed by various psychiatric classification groups. The subjects of the study were therefore limited to those diagnosed as reacting schizophrenically.
2. They had undergone relatively short periods of hospitalization.
3. They had not received previous EST or other shock therapy within six months of the time of this investigation.
4. They spoke English.
5. They had entered into a series of psychotherapeutic interviews of their own accord.

Experimental Variables

Four experimental situations were devised to carry out the investigation. In these situations the interview procedure remained constant while differing conditions of EST were employed. The first situation involved a group of subjects who were given psychotherapeutic interviews while receiving EST. The second situation involved the same group of subjects, but in this case they were given a series of psychotherapeutic interviews at the termination of EST. The third situation involved a second group of subjects who had concluded EST treatments but had not received previous individual psychotherapy. The fourth situation involved a final group—in some measures a control for the other three—who did not receive EST during this period of investigation.

Procedure

The material produced during the experimental interviews was electrically recorded and reproduced in transcripts. The interview series consisted of 30-minute sessions held three times a week until a total of 12 had been reached. The typescripts were scored for each of the three scoring measures, and statistical comparisons were made between various experimental groups.

Results

The scoring characteristics derived from interviews conducted during EST showed improvement for the entire series. However, statistically significant differences existed between the first and last half of the series, an initial improvement being followed by a decline in performance. This difference was beyond the .001 level of confidence for a combination of all three measures.

The same group of people seen post-EST showed continued over-all improvement in Efficiency Index and Global Rating scores. The amount of talk, however, declined. The trends for Efficiency Index and Global Rating scores showed an initial decline followed by a rapid improvement during the last half of the interview series. These differences were significant at the .05 and .001 levels of confidence. The amount of talk did not show significant variation between the first and last halves of the interview series.

Those subjects seen for interviews following EST who had not had previous psychotherapy demonstrated a decline in all scores for the entire interview series. This decline was more pronounced during the last six interviews.

Scores from subjects who had no EST showed over-all declines in Thought Unit and Efficiency Index scores. Global Rating scores improved slightly. The amount of talk diminished rapidly during the first six interviews and increased by an equal amount during the last half of the series. This difference was significant at the .001 level of confidence. The other two measures did not yield statistically significant trends.

Statistical comparisons between the various experimental situations indicated the following differences:

1. Characteristics of interviews conducted during EST do not differ from characteristics obtained from the same subjects following the termination of shock.
2. Interviews conducted with subjects undergoing EST differ significantly from those conducted with subjects who have terminated EST and have had no previous psychotherapy. The combined scores indicate that this difference is significant at the .001 level of confidence.
3. Thought Unit count and Efficiency Index values showed important differences for those individuals undergoing EST as contrasted with those subjects who had not received shock. However, Global Ratings for these two groups did not show any important differences.
4. Psychotherapy conducted during EST is of importance in later psychotherapeutic situations. This is indicated by an .01 level of confidence between the scores obtained from those subjects who had terminated EST and had had previous psychotherapy and the group of subjects who had terminated EST and had not had previous psychotherapy.
5. There were no statistically significant differences between the interview characteristics of subjects who had had previous psychotherapy and had terminated EST and those subjects who had not had EST.
6. The decline in functioning of those individuals who had terminated EST and had not had previous psychotherapy does not differ from the decline in performance of individuals who had not had EST.

Conclusions

1. EST increases the possibilities of therapeutic accessibility.
2. During the course of EST, there is a rapid initial rise in accessibility, which is followed by a decline. This circumstance indicates that psychotherapy is most beneficial when given during the initial stage of EST treatment.
3. It is possible to conduct individual psychotherapy profitably during the course of EST. However, far more beneficial results can be obtained if it is conducted during the course of EST and is followed by further psychotherapy at the termination of shock treatment.
4. If the initiation of individual psychotherapy is delayed until the termination of EST, the possibilities of early success are less favorable than when psychotherapy has been conducted during EST.
5. Psychotherapy conducted as an adjunct to EST is of greater benefit than EST alone. By generalization, it is believed that any form of therapy accompanying EST is beneficial.
6. It is possible to predict the relative benefits of EST within a period of two weeks subsequent to the termination of shock treatments. 109 pages. $2.00. Mic 58-4439

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EDUCATIONAL APPROACH AND PUPIL PERSONALITY

(Publication No. 21,694)

Mildred Satinoff Antonelli, Ph.D.
New York University, 1957

Chairman: Professor Florence C. Halpern

This was an investigation to determine whether personalities of children in schools emphasizing subject matter and having a rigid structure, referred to as Type A schools, differ in certain ways from personalities of children in schools having a more flexible structure and a mental hygiene approach, referred to as Type B schools. Hypotheses were that Type A children would differ from Type B children in perception of the role of authority toward children, in perception of the role of children toward authority, in perception of peer relationships, in perception of the classroom situation, and in response to frustrating situations.

Subjects were 36 boys in the fourth, fifth, and sixth grades of two Type A schools, and 36 boys in the fourth, fifth, and sixth grades of two Type B schools.

Instruments used were the Michigan Picture Story Test, the Rosenzweig Picture-Frustration Test, and the Draw-a-Class Test, in which instructions were to draw a class with a teacher.

The percentages of them in the Michigan Picture Stories Test in each of the categories and sub-categories considered relevant to the study were compared for the two groups by means of "t" tests. The same was done for the various scoring categories of the Rosenzweig P-F. Differences between the two groups on relevant aspects of the drawings were compared by determining the standard error of the differences.

Both groups tended to perceive authority as more negative than positive toward children. Group B children more frequently perceived authority as negative in feeling

toward children and showed more variability in their perception of the role of authority. Group A children showed a greater tendency than did Group B children to perceive children as being directly submissive toward authority. In Group A the percentage of responses in which children were perceived as aggressive toward authority was significantly greater than the percentage of responses in which children were perceived as submissive or as self-realizing. Children were perceived as submissive as often as they were perceived as self-realizing. In Group B the percentage of aggressive responses was no greater than the percentage of responses in which children were self-realizing. The percentage of responses in which children were submissive was significantly less than the percentage of responses in which children were perceived as aggressive or as self-realizing. Both groups showed a significantly greater tendency to perceive peer relationships as positive rather than negative, but the emphasis on the positive aspect of peer relationships was significantly greater in Group B. In Group A, unlike Group B, there was a high percentage of responses in which relationships between peers were defined as neither positive nor negative. The two groups were essentially similar in their response to frustrating situations except for the greater variability of Group B in the tendency to respond in a manner indicating guilt. The two groups were similar in their perception of the classroom situation, except for the greater tendency of Group A children to perceive the teacher as being overwhelming in size in comparison to the children.

Conclusions are: The impact of the school is not great enough to markedly affect the basic personality of children. Children in schools emphasizing social and personality development appear to be more aware of their feelings and likely to relate with feelings to others. They have a greater potential for forming positive relations with other children. They appear to be more suspicious of adults and more likely to attribute malevolence to them. They have more confused and varied views of relationships with authority than have children in the more traditional schools.

189 pages. $2.50. Mic 58-4440

ATTITUDE CHANGES DURING PSYCHOTHERAPY: INDIVIDUAL CHANGES IN IDEOLOGY AS MEASURED BY THE "R" AND "PEC" SCALES UNDER THE INFLUENCE OF PSYCHOANALYTICALLY ORIENTED PSYCHOTHERAPY

(Publication No. 24,969)

Louis K. Baron, Ph.D.
New York University, 1957

An experiment was designed to investigate the impact of psychoanalytically oriented psychotherapy on the ideology of patients as shown in their religious and political-economic attitudes. These attitudes were measured by tests selected because they were standardized instruments shown to be valid and reliable in their respective areas. Four numerically equal groups of subjects were used -- one as a control, three to evaluate possible differences between therapists. Each of these groups were further subdivided into a lower and higher age category. Each group was retested after ten weeks; during which the experimental groups had thirty hours of psychotherapy. Difference scores were calculated for each subject in both areas measured and these were subjected to statistical analysis. The method of multiple factor analysis of variance was used, after an evaluation by the "t" test of the significance of the difference between means.

For the population of neurotic patients (diagnosed as personality disorder, obsession, hysteria, or anxiety condition) having at least average intelligence, without organic cause or psychotic psychopathology, from sixteen to fifty years of age, in at least the upper middle-income bracket, from professional or managerial occupations, and of either sex, it was concluded that:

With a psychotherapist who is at least a senior student at a psychoanalytic training institute which has an orientation similar to that of the Psychoanalytic Studies Institute in Philadelphia, and who has practiced the method of psychoanalytically oriented psychotherapy for at least five years, it appears to be tenable to hold that:

1) Psychoanalytically oriented psychotherapy exerts a statistically significant influence on the ideology of patients as shown in both their political-economic and religious attitudes.

2) This significant change of attitude is in a direction toward liberality -- being less rigid either pro or con.

3) There is no significant difference between therapists in effecting the above results.

4) There is no significant influence exerted in the areas of this study regarding the factor of age.

68 pages. $2.00. Mic 58-4441

A STUDY OF THE RELATIONSHIP BETWEEN SKILLS IN CERTAIN COGNITIVE AREAS AND CERTAIN PATTERNS INVOLVING ATTITUDES, INTERESTS AND IDENTIFICATIONS IN EIGHTH GRADE STUDENTS

(Publication No. 24,971)

Albert N. Berenberg, Ph.D.
New York University, 1957

The problem of this investigation was to study the relationship between skills in arithmetic and verbal function and the psychosexual identification of eighth grade junior high school pupils. It was attempted to determine whether there were psychosexual differences between boys with arithmetic skills a year or more in advance of their verbal skills and boys with verbal skills a year or more in advance of their arithmetic skills. It was also sought to determine the same relationship for girls.

It was hypothesized that insofar as the cognitive areas of arithmetic and verbal function were concerned that males with more feminine psychosexual identifications would tend to resemble females with more feminine psychosexual identifications to a greater extent than they would resemble males with more masculine psychosexual identifications.

It was further hypothesized that insofar as the cognitive areas of arithmetic and verbal function were concerned that females with more masculine psychosexual identifications would resemble males with more masculine psychosexual identifications to a greater extent than they would resemble females with more feminine psychosexual identifications.

It was finally hypothesized that the cognitive areas of arithmetic and verbal function were more significantly related to psychosexual identification than to the actual sex of the eighth grade students studied.

The related literature on sex differences and psychosexual differences in verbal and arithmetic skills was surveyed. Popular belief about female superiority in verbal areas was challenged in some studies and supported in others. Popular belief about male superiority in arithmetic areas was similarly challenged in some studies and supported in others. The few studies dealing with psychosexual identification and cognitive skills are largely speculative and not based on experimental proof.

In order to test the proposed hypotheses a battery of tests consisting of the Attitude-Interest Analysis Test, a modified Thematic Apperception Test and a Figure Drawing Test was administered to each student. Achievement in arithmetic and verbal function was measured by an advanced form of the Metropolitan Achievement Test.

Critical ratios were computed for each of the three tests of psychosexual identification between the males who were more proficient in arithmetic areas and the males who were more proficient in verbal areas, between females more proficient in arithmetic areas and females more proficient in verbal areas, between females more proficient in arithmetic areas and males more proficient in arithmetic, between females more proficient in verbal areas and males more proficient in verbal areas, between males more proficient in verbal areas and females more proficient in arithmetic areas and finally between males more proficient in arithmetic areas and females more proficient in verbal areas.

The evidence shows that with respect to the areas of arithmetic and verbal function that males who scored more masculinely resembled males who score more femininely to a greater extent than they resembled females who scored more masculinely on the tests of psychosexual identification used in the present study. Females who scored more masculinely resembled females who scored more femininely to a greater extent than they resembled males who scored more masculinely on the tests of psychosexual identification used in the present study. The findings of the present study fail to show that arithmetic and verbal skills are more significantly related to the psychosexual identification than to the actual sex of the individual. Conversely psychosexual identification is more closely related to the actual sex of the individual than to his cognitive skills. 122 pages. $2.00. Mic 58-4442

THE COGNITION OF MAGNITUDE: A COMPARATIVE STUDY OF NORMALS AND SCHIZOPHRENICS

(Publication No. 23,892)

Roger Maurice Albert Bibace, Ph.D.
Clark University, 1957

Supervisors: Bernard Kaplan, Leslie Phillips,. Heinz Werner

On the basis of certain notions from the developmental theories of Werner and Piaget a comparative study was undertaken with respect to the handling of problems of magnitude by normal and schizophrenic subjects.

The general assumption guiding this study was the following: adults who manifest overt disturbances of thought would, more than normal adults, utilize developmentally low processes, i.e., processes which are formally similar to those characteristic of the thought of young children. This assumption led to the specific hypothesis that schizophrenics would, to a greater degree than normal adults, employ such genetically early processes in the solution of problems involving quantitative and numerical relations. To test this hypothesis, a number of tasks were devised to bring to the fore the processes underlying a subject's solutions of problems concerned with magnitude.

Categories were evolved and genetically ordered for the purpose of classifying responses to each of the test problems. Statistical tests were then employed to determine whether any significant differences existed between the two groups in their use of lower developmental as compared to higher developmental processes.

The hypothesis was uniformly supported; it was found for all tasks, that the schizophrenic group employed, to a significantly greater degree than did the normal, processes characteristic of more primitive thinking.

Thus, the schizophrenics more typically showed:

(1) A tendency to concretely view quantity and number as inherent in classes of objects.

(2) A failure to maintain parts and whole in a discrete relationship of subordination; rather they centered on part to part relationships, often treating the whole as if it were coordinate with a part.

(3) A tendency to rely on perceptual signs in tasks requiring verbal-conceptual solutions. This tendency was most strikingly manifested when the perceptual material was incongruent with a verbal statement of relationships.

The findings of the experiment were interpreted in terms of the complementary formulations of Werner and Piaget. The advantages of developmental theories in the description of schizophrenic thought as compared with contemporary descriptive psychiatry were discussed.
90 pages. $2.00. Mic 58-4443

AN INVESTIGATION OF COGNITIVE STYLE AS A FUNCTION OF THE PERCEPTION OF HUMAN MOVEMENT IN INK BLOTS

(Publication No. 24,864)

Donald P. Cliggett, Ph.D.
New York University, 1957

Adviser: Robert R. Holt, Ph.D.

The purpose of this study was to investigate experimentally (1) the existence of two cognitive styles, a physically active and an ideational one, in the context of solving problems, (2) the consistency of these individual styles when problem content varied, (3) the relationship of this cognitive dimension of physical activity to the perception of movement in ambiguous visual forms and ambiguous spoken words, and (4) the independence of these cognitive styles, and the perception of movement, from intelligence.

The history of the problem and pertinent research was discussed. In a theoretical consideration of the problem, the dimension of physical activity in problem-solution, and movement-perception in ambiguous stimuli, was related to the sensory-tonic theory of perception and the work of Werner, Wapner and their associates. Ties to the psychoanalytic theory of thought were also indicated, and some of the work by Gardner, Holzman, Klein and their colleagues, on cognitive styles conceived as ego functions, was briefly described.

The major hypotheses were:

1. Individuals tend to be consistent in their use of a physically active or ideational style in solving problems, despite variations in the content and character of those problems.

2. Those persons who easily perceive human movement in ink blots, in contrast to those who are less "perceptive" in this sense, are inclined to be less active physically in their efforts at problem solution.

3. Those persons who perceive M responses readily in ink blots, when compared with those who do not, are also more sensitive to the movement implications of ambiguous words.

4. The perception of movement in ink blots, and of action in ambiguous words, and the amount of physical activity in problem solution are not significantly related to intelligence.

The subjects were 50 male, white, veteran, out-patients at a Veterans' Administration Mental Hygiene Clinic. They ranged in I.Q. from 109-134, and none were actively psychotic or diagnosed traumatic brain injury or chronic brain syndrome. None of the subjects were receiving tranquilizing medication. The age range was 20-46.

The procedure consisted of the administration of four different problem tasks, each allowing variation in the amount of physical activity used in the subject's efforts at solution. The tasks were a number puzzle, a word puzzle, anagrams, and selected items from the Luchins water-jar problems. A list of homophones was also read aloud to the subject, and he was instructed to make up a sentence for each, using each homophone in the first way that occurred to him. The Barron M-threshold ink blot test was also administered.

The results support the hypothesis of consistent cognitive styles. With reference to physical activity as an inverse function of movement perception in ink blots, the hypothesis is supported in one of the four problem tasks. Trends in the predicted direction on the other three suggest that the relationship which exists is not a close one and could be attenuated by other variables specific to each task. Sensitivity to movement implications in ambiguous words is related to such sensitivity with ink blots. Although trends are evident, neither cognitive style nor sensitivity to movement in the ambiguous stimuli is significantly related to intelligence.

Possible areas of further research were discussed. The dynamic use of words and the genesis of creative writers as a possible function of extended periods of immobility was touched upon. The implications for various forms of mental illness and in certain types of psychiatric treatment were also explored.

81 pages. $2.00. Mic 58-4444

THE RELATIONSHIP OF THE PRISON PROGRAM TO CHANGES IN ATTITUDES AND SELF CONCEPTS OF INMATES: AN EVALUATION OF SELF-CONCEPT, ACCEPTANCE OF SELF, IDEAL SELF, AND PREDISPOSITION TOWARD CRIME AND DELINQUENCY IN PRISON INMATES

(Publication No. 24,975)

Howard Martin Cohen, Ph.D.
New York University, 1957

The purpose of this study was to evaluate the status of acceptance of self, discrepancy between self-concept and ideal self, predisposition toward crime and delinquency, and institutional adjustment in a group of male adult inmates of a medium security prison, at the beginning of incarceration, during incarceration, and at the time of release.

The population consisted of four groups of 30 inmates each. They met the criteria for the medium security prison, were between the ages of 19 and 35, had minimum I.Q.'s of 85, and had minimum reading levels of 5.5. The groups were equated for age, intelligence level and reading level.

Group A, the experimental group, was evaluated at admission, one month, two months, and eight months at a medium security prison. Groups B and C were tested at fifteen months and twenty months (pre-parole), respectively, at the same institution. Group D, the control group, was tested at admission and at the completion of eight months at a maximum security prison. The instruments used to evaluate Groups A, B, and C were the Index of Adjustment and Values, the De Scale of the California Psychological Inventory, and the Rating Scale for Institutional Adjustment. The Rating Scale was found to be reliable in an earlier pilot study.

Group D, the control group, was tested with the same instruments, with the exception of the Rating Scale for Institutional Adjustment.

The t test was used to test the hypotheses.

The hypothesis that there would be positive and progressive changes in institutional adjustment and the concept of acceptance of self in the inmates of the experimental group was not sustained. Acceptance of self scores did progress positively throughout the eight month period, but the mean institutional adjustment ratings changed unfavorably, although not significantly, between admission and the end of the first month. Nevertheless, from the first month stage to the eighth month stage, institutional adjustment did improve to the point of statistical significance.

The second hypothesis, that there would be progressive decreases in the discrepancy between self-concept and ideal self, and in predispositional factors for crime and delinquency in the experimental group, was sustained. These variables progressively decreased after admission, attaining statistical significance at the second month.

The third hypothesis, that the changes in these characteristics, in the direction indicated, would be greater for the experimental group than for the control group over an eight month period, was sustained. There were statistically significant differences between the experimental and control groups in terms of the variables, acceptance of self, discrepancy between self-concept and ideal self, and predispositional factors for crime and delinquency.

The mean scores of the control group did not change significantly from admission to eight months in any of the variables studied. The groups studied at fifteen months and twenty months at the medium security prison did not differ significantly from the experimental group at eight months.

An analysis of the findings indicates that the group studied for eight months at the medium security prison improved considerably. There was a greater ability to accept oneself, a lesser degree of personal maladjustment and a lowering of the potential toward crime and delinquency. Further, there was increased adjustment to the institution after the first month.

The findings demonstrate that favorable changes in offenders can be achieved, while they are inmates of treatment-oriented institutions. In addition, it appears that the inmates attain the maximum benefit from such a program by eight months and that continued incarceration produces no further favorable change.

177 pages. $2.35. Mic 58-4445

KUDER PREFERENCE RECORD RESPONSES OF A SELECTED GROUP OF SCHIZOPHRENICS (COUNSELING REFERRALS) AS A FUNCTION OF PERSONALITY TRAITS

(Publication No. 24,865)

Merle E. Day, Ph.D.
New York University, 1957

Adviser: Robert R. Holt

This study attempted to verify and explore consistent research findings which related maladjustment and psychopathology to higher Artistic, Literary and Musical scale scores on the Kuder Preference Record. As there had been no previously reported data as to the reliability of the K.P.R. with psychopathological groups, stability and internal consistency were evaluated. A design was established which would permit the separation and evaluation of the influences of age, intelligence, education and previous work experience on the separate Kuder scales. In this way, the effect of group membership in the control or psychopathological group could be clearly tested. The following hypotheses were formulated.

1. The KPR scales are internally consistent and have satisfactory stability when used with a psychopathological group similar to the hospital sample in this study.
2. The psychopathological group will differ from the controls in the direction of higher Artistic, Literary and Musical scale scores.
3. Item analysis should permit the extraction of a scale or scales which would differentiate between the schizophrenic and control groups with greater efficiency than the specific Kuder scales.

A control group of white, male, veteran, counseling referrals was compared with a hospital group of white, male, veteran, schizophrenic, counseling referrals on the Kuder Preference Record (Form BB). Each member of the hospital group had a schizophrenic diagnosis with no secondary diagnoses. No member of the control group had any service-connected disability and sampling criteria were designed to exclude maladjusted individuals. Data were obtained to permit the equation of age, intelligence, education and previous work experience.

Internal consistency coefficients were computed for the schizophrenic and control group. Stability coefficients were obtained on a group of 30 schizophrenics with a test-retest interval of three weeks. The first hypothesis was supported as the obtained coefficients, with one exception, compare satisfactorily with those reported in previous research with normals.

No group profile differences on the KPR were found for the total sample or in an analysis of variance of selected sub-groups. The analysis of variance permitted the crude equation of the sampling variables. The data suggest that experience variables influence K.P.R. profile more than the variable of group membership. The second hypothesis was not confirmed.

An item analysis extracted 38 triads from the 168 Kuder triad items. There was a significant difference in the group frequency in response patterns to these items evaluated by Chi Square. Use of these items as a scale produced a significant mean difference between 50 cases from the schizophrenic and control groups. There was no significant difference between the means obtained by the 20 most successful and least successful counseling cases in the schizophrenic group. The content of the extracted items indicates that an attitude of passivity was strongly represented in the response tendencies to these 38 items for the schizophrenic group. This was discussed as a trait which could not be clearly related to group membership or successful outcome of counseling.

The third hypothesis depended on the emergence of specific differences between the control and schizophrenic groups. As these differences did not appear, the results of the item analysis were presented for their hypothesis forming value. Variability was so great that the scale could not be used effectively to predict group membership.

The results do not confirm the existence of a particular K.P.R. interest pattern related to psychopathology. The data suggest marked differences in interest pattern between Kuder's normative group and a group of normal veterans seeking vocational counseling.

85 pages. $2.00. Mic 58-4446

THE INFLUENCE OF THE LEVELING-SHARPENING CONTINUUM ON NEED FOR ACHIEVEMENT

(Publication No. 24,785)

Juliet C. Diller, Ph.D.
New York University, 1955

Adviser: Dr. Irwin Katz

Problem. This experiment was designed to study the relationship between perceptual attitude, more specifically, the leveling-sharpening attitude, and the strength of need for achievement under relaxed and under ego-involved conditions.

Subjects. One hundred and forty eight male college students,

enrolled in psychology courses at University College of New York University, were utilized as subjects for the experiment.

Procedure.

1. The multiple choice test. An eight item multiple choice test was given to each subject upon entrance into the testing room. This measure was designed to tap conscious self descriptions by each subject of his usual behavior in achievement-related situations.

2. The "size of a square" test. Levelers were distinguished from sharpeners on the basis of performance on a psychophysical task, the "size of a square" test, according to a procedure used by Klein.

3. The four picture test. Immediately after taking the "size of a square" test, all subjects were given the four picture test according to instructions published by McClelland.

a. Relaxed conditions. One half of the total population, or 75 subjects, were given the four picture test with instructions designed to induce an atmosphere of casualness and relaxation.

b. Ego-involved conditions. The remaining half of the population, or 73 subjects, were given the four picture test with instructions designed to arouse a state of "ego-involvement", or a concern with the quality of performance, in each subject.

Treatment of the data.

1. Levelers and sharpeners. Levelers were distinguished from sharpeners on the basis of two criteria which were applied to the data obtained from responses to the "size of a square" test, namely the "Embeddedness" and the "Adaptive lag" criteria.

2. Need achievement scores. The need achievement scores of levelers and sharpeners in both experimental conditions were determined by two judges, working independently, who followed an objective scoring system devised by McClelland.

3. Relationship between levelers and sharpeners and their need achievement scores. The relationship between perceptual attitude and the strength of the achievement motive was assessed by analysis of variance techniques, appropriate t tests and chi square tests.

4. Relationship between the "Embeddedness" and the "Adaptive lag" criteria. The relationship between the "Embeddedness" and the "Adaptive lag" criteria was determined by the use of product-moment correlation procedures.

5. The multiple choice test. The replies of levelers and sharpeners to the multiple choice test were scaled on the basis of 1-4 (1 representing the highest and 4 the lowest degree of competitiveness) and also dichotomously. The relationship of these responses to the leveling-sharpening continuum and to the need achievement scores was determined by analysis of variance techniques, appropriate t tests and product-moment coefficients of correlation.

Results.

1. An application of the "Embeddedness" measure to our data revealed no significant differences between strength of achievement drive in levelers and sharpeners in either the relaxed or in the ego-involved conditions. Also, the multiple choice test failed to distinguish between levelers and sharpeners.

2. An application of the "Adaptive lag" measure to our data disclosed the existence of a significant interaction between the perceptual groups and the experimental conditions with regard to the need achievement scores ($p = .01$). The significance of this interaction, however, was limited by the following additional findings:

a. Chi square tests did not confirm these differences in response.

b. Also, analysis of the responses of the extremes of these perceptual groups did not support this finding.

3. An item analysis of the responses to the ten subcategories of the need achievement score yielded one F significant at the .05 level. Since only one of the ten subcategories produced these results, this probability level over-estimates its significance.

4. No evidence was found to substantiate the hypothetical relationship between the "Embeddedness" and the "Adaptive lag" criteria.

Discussion. The above findings were discussed in terms of the theory, instruments and conditions utilized in this study. 128 pages. $2.00. Mic 58-4447

THE EFFECT OF EXPERIMENTALLY INDUCED ANXIETY ON CERTAIN SUBTESTS OF THE WECHSLER-BELLEVUE

(Publication No. 25,022)

Jack Stewart Griffiths, Ph.D.
University of Kentucky, 1952

The purpose of this study was to test the validity of the hypothesis that performance on the Digit Span subtest of the Wechsler-Bellevue is adversely affected by the presence of anxiety, and that only this subtest is so affected.

In order to test the validity of this hypothesis, an experiment was designed in which sixty Freshmen students were tested on the Digit Span subtest after they had experienced an anxiety-producing situation. Anxiety was induced by preceding the actual subtests with a pseudo-testing situation in which the subjects were made to fail. To provide a standard for comparison of the effects of anxiety, the subjects served as their own control group and were also tested under standard conditions of administration. Preceding the standard administration, the pseudo-testing situation was structured so that the subjects would always succeed.

To determine whether or not the effect of anxiety upon Digit Span was unique, four additional subtests were administered each time with the Digit Span subtest. The four additional subtests were Information, Arithmetic, Object Assembly, and Digit Symbol.

A modified method of scoring was introduced which resulted in a stricter criterion of success for Digit Span, and which gave greater weight to speed of reaction on the other subtests.

Comparisons were made of scores obtained under the two conditions of testing and the significance of changes in mean scores for each of the subtests was determined.

The results of these comparisons showed that the performance on Digit Span was significantly lowered, and that there is an increase in the number of failures before the final level of ability is attained. These conclusions were found to be true for each of the four common measures of digit span, that is, forward, backward, total, and weighted

scores. In addition, the impairment in performance was significant whether the span was considered as the number of digits recalled before the first error, or the number of digits recalled before two consecutive errors. A higher level of confidence that there was a true difference between the conditions was obtained by using the stricter measure. All differences in performance were significant at the .005 level of confidence or better.

Concerning the effect of anxiety upon performance on the other subtests of the experiment, it was found that performance on the Information subtest was significantly inferior under the influence of anxiety. That is, the subjects were less able to bring forth facts from their store of knowledge in the presence of anxiety. Thus, it is demonstrated that the part of the hypothesis which holds that the deleterious effect of anxiety is uniquely reflected by Digit Span is invalid.

A significant change in level of achievement in the presence of anxiety occurred on none of the remaining subtests--Arithmetic, Object Assembly, and Digit Symbol.

These findings were interpreted as an interference with the memory process by anxiety. On Digit Span the interference was interpreted as occurring primarily during perception and retention, rather than during recall. The nature of the interference was found to be the intrusion of inappropriate thoughts, loss of interest, change of attitude, and/or an active psychological withdrawal from the testing situation. 97 pages. $2.00. Mic 58-4448

GENERALITY OF PERSONAL CONSTRUCTS

(Publication No. 25,481)

Rachel Jane Hamilton, Ph.D.
The Ohio State University, 1952

The psychologist working in a clinical situation is often called upon to make predictions about the future behavior of people in a variety of situations. According to the psychology of personal constructs, now being developed by G. A. Kelly[1], such predictions are likely to be more accurate if the psychologist has some knowledge of the person's expectations of other people and the dimensions along which he is free to move. The expectations and dimensions are believed to be shown by the person's constructs. (A construct is defined as a way in which two things are perceived as being alike and yet different from a third thing.) It is held that as a person has participated in or observed events, he has formed constructs about those events, and the constructs have been directed toward optimal anticipation of future events. In construing people, a person predicts what those people will do. His predictions or expectations of the actions of other people, in turn, help to determine his own actions.

A person's constructs about people are believed to be symbolized by the words he uses to describe people, but these words are not the constructs themselves. Since constructs are believed to be dimensional in nature, a descriptive term and its antonym provide a better knowledge of a construct than does the descriptive term alone.

Both the psychology of personal constructs and the writer's observations in a clinical setting lead to the question of whether constructs used by a person in one situation are likely to be used by that person in other situations. Specifically, the question investigated in the present research is whether constructs about people elicited by a picture test and by a form of Kelly's Repertory Test[1] have sufficient generality to appear in situations other than the particular test which elicited them. (The generality of a construct is defined by the number of elements that the construct subsumes.) The major attention was directed toward the generality of constructs elicited by the pictured figures, but several related questions were investigated simultaneously. The experimental variables included particular drawings, age-sex group membership of pictured figures and real people described, individual construction systems, and specific types of test (here pictures versus names of real people as stimulus material). The relationship between personal constructs and the particular pictures that elicited them was studied because a close relationship implies a limit to the generality of the construct obtained with pictures. The relationship between constructs elicited by two different parts of a single (picture) test was studied because if generality of constructs can be shown at all, it should appear here. The relationship between constructs elicited by two different tests was studied because a close relationship implies that constructs obtained on one test are not entirely specific to that test, i.e., they have a wider degree of generality than the one test situation. Two possible areas within which constructs may show generality - age group and sex group - were also studied. The experimental design used made it necessary to investigate the personal quality of constructs at the same time that the generality of constructs was being tested.

The experiment was divided into two parts: the testing of the subjects and the handling of the test data by the method of correct matching. Undergraduate men were given two tests in which they were required to describe the "personality" or "character" of people. Kelly's Repertory Test employs a combination of a forced choice technique and a sorting method to make the subjects compare and describe twelve people (in four age-sex groups) whom they know well. The picture test consisted of a selection of twelve figures (in four age-sex groups) from the Murray[2] and Symonds[3] sets of cards; subjects were required to list three or four adjectives or short phrases descriptive of the character or personality of each figure. Both the tests were set up so that the data obtained included both descriptive terms and what the subjects conceived to be the antonyms of the descriptive terms. The protocols or parts of protocols from the two tests were broken up in various ways, and two trained judges were instructed to try to recombine them, matching the parts that belonged together according to certain specifications. The degree of relationship between the materials matched and the significance of the relationship were studied by means of Vernon's modified contingency coefficient[4]. The number of correct matches made by the judges was compared with the number to be expected from chance alone by means of critical ratios. The patterns of correct matches made by the judges was compared with the patterns to be expected from chance alone by means of chi-square.

Four main hypotheses were tested, and two of the main hypotheses were divided into sub-hypotheses; thus there were seven hypotheses and sub-hypotheses. Tests of six of the hypotheses and sub-hypotheses were significant at high levels of confidence. The test of the other hypothesis

showed borderline statistical significance. The accuracy of matching for most of the hypotheses was good enough that the results can be considered to have practical as well as statistical significance. The following results were demonstrated for the subjects used.

1. There were both perceptible relationships between certain TAT-type drawings and the descriptions elicited by those drawings, and perceptible distinctions between descriptions elicited by different drawings. The descriptions of some of the pictured figures were more easily identified than the descriptions of other figures. Also, the descriptions by some subjects appeared to be more closely related to the drawings than did the descriptions by other subjects.

2. There were both perceptible relationships between the descriptions of various pictured figures given by any one subject and perceptible distinctions between the descriptions of the same figures given by different subjects. These relationships and distinctions were shown both when the age-sex group to which the figures belonged was the same for the two sets of materials to be matched and when the age-sex group of the figures in the two sets of materials was different.

3. There were both perceptible relationships between the descriptions of pictured figures and real people given by any one subject, and distinctions between the descriptions of the same figures and people given by different subjects. Only the case where the age-sex group was the same for the people in the two sets of materials to be matched was studied.

The ability of the judges to match picture descriptions in terms of the age-sex group membership of the figures described appears to be of borderline statistical significance. The borderline character of the statistical tests and the good ability of the judges to match protocols in terms of subjects, even when the age-sex group membership of the two sets of descriptions differed, suggests that these subjects did not show many practically important differentiations between the personalities of pictured figures in terms of the age and sex of the figures.

For all the hypotheses tested the two judges showed better than chance agreement in terms of the number of identical matches. In terms of the pattern of number of correct matches for the various sets of materials, the judges showed no significant difference in tests of five of the hypotheses and sub-hypotheses, but they did differ significantly in tests of two of the hypotheses and sub-hypotheses.

From the results of the experiment the following conclusions appear to be justified.

1. Constructs elicited by pictured figures and by a form of Kelly's Repertory Test do have some generality at least to another test situation. That is, constructs elicited by these two tests are not wholly specific to the particular test that elicited them. Therefore, the possibility is increased that constructs elicited by one of these tests will be used in other, non-test situations.

2. There is a limitation to the generality of some of the constructs elicited by pictured figures, for it has been shown that for some subjects there are both perceptible relationships between some pictured figures and the constructs elicited by them, and perceptible distinctions between the constructs elicited by different figures. Psychologists should beware of assuming that because a subject describes one person or a small number of people in a certain way, he will necessarily describe many people in the same way. At most, the description of one person or a few people can show what constructs are in a subject's repertory and therefore what ones he may use in other situations.

3. In spite of the above conclusion, constructs elicited by pictured figures apparently are not related solely to the situation in which they are elicited, and there is an important personal quality in the construct systems of individuals. As an aid in increasing understanding and reducing misunderstanding, it appears advisable for psychologists to determine not only the verbal symbols but also the construct dimensions that are frequently used by their patients.

4. Generality of many of the constructs does not appear to occur in terms of age-sex group, at least for the subjects tested. It is consistent with the psychology of personal constructs to expect that superordinate constructs under whose regnancy generality may occur will vary from one subject to another. Incidental results of this experiment suggest the use by many subjects of the dimension "like-dislike" as such a construct.

5. Occasional misperceptions of the age and/or sex of pictured figures appears to occur in about one-third of college men. Investigation of their significance is needed.

376 pages. $4.80. Mic 58-4449

1. Kelly, G. A. "The Psychological Construction of Life." (Manuscript)

2. Murray, H. A. Thematic Apperception Test. Cambridge: Harvard Univ. Press, 1938, co. 1943. (Set of 30 cards and manual.)

3. Symonds, P. M. Symonds Picture-Story Test. N.Y.: Bureau of Publications, Teachers College, Columbia Univ., 1948. (Set of 20 cards and manual.)

4. Vernon, P. E. "The Matching Method Applied to Investigations of Personality," Psychol. Bull., 33 (1936), pp. 149-177.

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EXPECTANCY AND EXPECTANCY CHANGES IN NORMAL AND MENTALLY RETARDED BOYS

(Publication No. 24,475)

Richard Franz Heber, Ph.D.
George Peabody College for Teachers, 1957

Major Professor: Rue L. Cromwell

The first part of the study was concerned with generalized expectancies for success and failure in mentally retarded and normal boys. Sixty mentally retarded boys were matched with boys of average and above average intelligence in performance efficiency on a reaction time task. Following the matching trials, 21 trials were given on the reaction time task. Half of the subjects in each group were told that they were successful, and the other half were told that they had failed, on 19 of the 21 trials. It was assumed, within the framework of social learning theory, that mentally retarded subjects would enter a novel situation with a low generalized expectancy for success as

a function of a preponderance of failure experiences in prior life situations. As predicted from this assumption, a series of success experiences brought a greater increment in performance in retarded than in normal subjects. Contrary to predictions, both retarded and normal subjects showed an increment rather than a decrement in performance under the failure condition. This increase occurred during the first half of failure trials. A decrement in performance during the last half of failure trials suggested an inverted U-shaped curve for the data.

The second part of the study was primarily concerned with the effect of goal value on expectancy. Contrary to past research, which has found a relationship between the two constructs, the present study inferred expectancy from performance efficiency rather than subjects' verbal estimates. One hundred and twenty-eight normal subjects had either a high or low expectancy established on a reaction time task while performing under either a high or low reinforcement value condition. Immediately following, a similar task was presented with the subjects again performing under either a high or low reinforcement value condition. These three treatment variables resulted in a 2x2x2 factorial analysis of variance design. As predicted, the reinforcement value (on the first task) originally associated with the generalized expectancy did not have any effect on performance of the second task. This finding supported the hypothesis of social learning theory that expectancy, as measured by performance efficiency, is not influenced by goal value.

An interaction was found between expectancy and reinforcement value on the second task. High reinforcement value resulted in greater performance efficiency than low reinforcement value under low expectancy conditions but not under high expectancy conditions. Directly opposite from the social learning theory prediction, low expectancy resulted in greater performance efficiency than high expectancy under high reinforcement value conditions. No difference as a function of expectancy was found under low reinforcement value conditions.

122 pages. $2.00. Mic 58-4450

PSYCHOLOGICAL CHANGE AS REVEALED BY SELF-DESCRIPTIONS

(Publication No. 24,499)

Alvin Ray Howard, Ph.D.
The Ohio State University, 1951

The study was designed to examine the psychological changes (movement) of neuropsychiatric patients by means of their written self-descriptions. The basis of most of the theoretical thinking is to be found in Kelly's[1] "The Psychological Construction of Life."

THEORETICAL ORIENTATION

Persons employed in an institutional setting have frequently observed that many patients respond willingly to frank questions about themselves despite a display of reticence in the face of the Rorschach, TAT, or similar technique. Concurring in this observation, we proceeded directly to the source to ascertain the fruitfulness of the less "surreptitious" method.

We operated on the assumption that the therapeutic situation is one designed to hasten the process of change. In therapy we offer the patient a situation in which the construction of change may be facilitated. The therapeutic situation provides him with a framework in which he may structure changes taking place. Although he may accomplish this to some extent in "unguided real life," the therapist helps him toward a more rapid realization of what is taking place. Under the therapist's guidance, he becomes more effective in perceiving the changes, extensive and limited, that he has undergone. In addition, the patient is helped to become more aware of the likelihood of future changes. He broadens his perspective to encompass more distant goals; his construction of events runs ahead of the more readily observable behavioral changes.

In this study, the terms "movement" and "change" were regarded as synonymous; the definition proposed was that of a constantly varying behavioral process. Movement was discussed in two contexts, measured and perceived. Measured movement refers to the variations noted in behavior deriving from observation of the individual (via his self-descriptions) on two separate occasions. Perceived movement denotes the variations ascribed by the individual to himself at two instants in time.

Analysis was confined to "past" and "present" self-descriptions, i.e., characterizations of the individual written by himself. We contend that upon recalling past events the individual tends to focus upon the most contrasting of these events -- the "sharper" details out of a time telescoped. This "contrast" phenomenon is not unlike that which may be ascribed to the investigations of Bartlett,[2] Zeigarnik[3] and Ovsiankina,[4] among others. Bartlett effectively demonstrated that past experiences influence present perceptions and that recall of these perceptions changes with time through reorganization of the past. In the repeated reproduction of stories, for example, certain elements are successively distorted so that they become increasingly removed from the originals. This process of distortion we have chosen to term a contrast from the measured (or original) perception. The studies of Zeigarnik and Ovsiankina may be similarly viewed. They demonstrated the tendency of individuals to recall interrupted tasks more often than tasks which had been completed. The aim was completion, and when the aim was not met, the contrast was sufficiently great to engender greater remembrance of the failures.

THE SAMPLE

Thirty male patients in a Veterans Administration neuropsychiatric hospital were the subjects of this study. All were veterans of World War I or II. Each was individually requested to write three self-descriptions in the presence of the examiner. The first request (A for admission) occurred at the time of initial admission, or upon readmission, to the hospital. In most cases, this meant either the day of, or the day following, arrival. In the few remaining instances, persons appearing during a week end were seen on the subsequent Monday. The second (L for later) and third (LA for a later protocol which concerned status upon admission) self-descriptions were solicited (in alternate order for every other subject) five weeks $\pm$ 1 day following the completion of A.

THE HYPOTHESES

Three hypotheses were tested. In the first of these, no distinction was made between first admissions and

readmissions; in the second and third hypotheses, the performance of these groups was contrasted. They are listed below in experimental terms:

1) Perceived movement (L-LA) is greater than measured movement (L-A).
2) Perceived movement of first admissions is greater than the perceived movement of returnees, the degree of movement varying with number and duration of prior hospitalizations.
3) Measured movement of first admissions is greater than the measured movement of returnees, the degree of movement varying with number and duration of prior hospitalizations.

It will be noted that the first (main) hypothesis derives from the attempt to determine whether the therapeutic (hospital) situation does facilitate the construction of events to the extent that the construction exceeds the behavioral variations evident in an individual's self-descriptions written on two separate occasions. In order to test the two subordinate hypotheses, the sample was divided into two groups according to whether the subjects were first admissions or readmissions. We have postulated in each case that the changes manifested by the new admissions will exceed those of the readmissions. This derives from the theoretical deduction that first admissions are in an even more accelerated therapy situation than readmissions by virtue of the perceived novelty of the situation for them. For the readmissions there is less novelty, less contrast from one confinement to the next.

PROCEDURE AND RESULTS

Protocols were divided into thought-units mainly following the procedure outlined by Bugental.[5] Three judges analyzed each protocol in terms of (1) a global rating (on a nine-point scale) of the subject's perception of his condition, (2) designating each thought-unit as strength, threat, or neither (modified from Barry),[6] and (3) categorizing each threat as one or more of eight foci of conflict. Three ratios were employed: number of strengths to number of threats (S/T), number of strengths to combined number of strengths and threats (S/S+ T), and number of strengths to total number of units (S/S+ T+ N) in a given protocol. Foci of conflict were analyzed in terms of number and kinds.

In addition to the "original" protocol, i.e., that tendered initially by a subject, three variations were utilized to offset the effects of the incomplete adherence to instructions so characteristic of our sample of hospital patients. In the "fixed" protocol, various units were reassigned so as to include them within the frame of other self-description(s) written by the same individual. "Historical" items, such as birth date, data concerning early education, and the like, if originally written at L, were assigned to LA. When these items were included at A or LA, they remained as part of these protocols. Verb tense served as a discriminator with other kinds of thought-units. The "fixed without historical" protocol corresponded to the "fixed" protocol after case history items had been excluded. This refinement served to eliminate the influence of units alluding to events which occurred long before admission to the hospital; as such, they had no place in any of the self-descriptions requested. The final variation used was termed the "pure" protocol, which was composed of "original" units which had remained untouched during the "fixed" and "fixed without historical" analyses.

The main experimental hypothesis was supported at better than the 1 per cent level by four measures: (1) "fixed without historical" and "pure" S/S+ T and S/S+ T+ N; (2) at better than the 2 per cent level by both "fixed" S/S+ T and S/S+ T+ N; (3) at better than the 5 per cent level by "fixed without historical"; and (4) "pure" S/T, the last barely beneath the 2 per cent level.

The second hypothesis was supported at better than the 1 per cent level by "original" S/S+ T and S/S+ T+ N and at better than the 5 per cent level by global ratings and "pure" kinds of foci, except that the effect of frequency and duration of hospitalization was negligible.

The third hypothesis was not supported significantly by any measure employed.

IMPLICATIONS

It is believed that in the self-description we have one answer to the problem posed by Rogers,[7] of developing methods of perceiving the individual's circumstances as they appear to him. It is likewise believed that case histories afford hypotheses for predicting the extent of an individual's movement in a given situation and within a specified length of time. Our guess would be that certain construction systems held earlier, or certain cultural characteristics to which an individual has been exposed, tend to hinder movement; others, however, tend to facilitate movement. For example, the person who construes life apart from his mother as unbearable would be expected to anticipate movement backward in an institutional framework. On the other hand, the individual who has been actively striving for years to sever the umbilical cord may welcome a hospital environment relatively free from patronizing authority figures and construe forward movement within such a situation. Again, we would predict "regression" on the part of adherents to an atmosphere of cultural propriety when they are exposed to the customary inelegancies of institutional existence.

If it is admitted that the fundamental aim of therapy is the stimulation of more rapid change in the patient than would result from his own unguided efforts, then in successful therapy the individual must feel that he is changing, or at least perceive himself to be capable of changing. If the patient is being helped to change more quickly, his perception of change should reveal itself in sharper contrast than his measured (or actual) change. Encouraged by the utility of the therapeutic framework, he perceives the resultant changes to be greater than the outside observer would acknowledge. In terms of the main experimental hypothesis, perceived movement will exceed measured movement.

The classroom situation is likewise viewed as an accelerated change situation. To realize the maximum from his attendance, the student must develop the notion that he is in the process of changing; perceiving no change, he may inquire, What good is an education? As he perceives that he is learning, as he perceives that school experiences are making him different from what he was earlier, his assimilation rate may be expected to accelerate (at least for a time). Perhaps test results and grades (the measured change) will fail to reveal movement as extensive as that perceived by the student; nevertheless,

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if he perceives a greater change in terms of some personal norm, it should, for the serious student at least, provide sufficient incentive for further change. As long as he contrasts a prior status with his "better educated" status of the moment, he will continue to view his school experiences as desirable events.

Perhaps, then, our use of objective tests (in school and elsewhere), group norms, and grades has too long overemphasized status and disregarded the essential aim, movement. More stress must be placed upon the individual's perceptions of the learning process. If he views a situation as beneficial to him, his continuance in that situation should be facilitated. If he feels that he is learning something in the classroom, he will seek further education. Why risk stifling incentive, even in the formative years, with final grades which so frequently imply a completed education to that point? Perhaps a more useful approach would be to ask the student what he believes he has learned and then clarify the facts relating to those issues on which he appears to be misinformed. In this manner, we first pay heed to the person's perceptions and we do not hamper initiative to the degree that may occur when an arbitrary standard (a desired measured status) is imposed from above.

CONCLUSIONS

On the basis of various analyses, the following conclusions seem warranted:

1) Movement (or change), as discussed by Kelly,[1] is exhibited by institutionalized patients even during the relatively brief interval of five weeks.

2) As stated in the main experimental hypothesis, perceived movement significantly exceeds measured movement.

3) Contrary to hypotheses 2 and 3, it cannot be said without qualification that persons admitted to a neuropsychiatric hospital for the first time manifest a greater degree of movement than persons returned a number of times to the same institution, although the data may be construed as suggesting a trend in this direction. This holds for both perceived and measured movement.

4) Also contrary to hypotheses 2 and 3, frequency of hospitalization, duration of hospitalization, and the product of these two measures insignificantly affect the degree of movement exhibited by the subjects in this investigation. Here the felt intensity of the hospitalization experience for the individual seems more important than the categories "new admission" and "readmission."

5) The ratio of strength units to threat units (S/T) is advanced as a definitive and substantially objective measure of movement.

6) "Pure" S/T is proposed as the most efficient method of strength-threat analysis; in some instances, the ratios S/S+ T and S/S+ T+ N are somewhat more useful, although they entail additional calculations.

7) Global rating of protocols, although intuitive to a much higher degree than strength-threat analysis, can provide reliable information subsequent to adequate training of judges.

8) It is more difficult to secure high interrater reliability in categorizing areas of conflict from written protocols. Pending a more adequate approach to this problem, negligible value derives from employing this technique for the purpose of guaging movement.

9) When open-ended instructions designed to elicit subject-written material are utilized with samples similar to the one used in this study, analysis will be improved by the use of "corrective" methods. The latter are herein discussed in regard to the reassignment of units deemed inappropriate to a given self-description.

10) The main experimental hypothesis is believed to provide a basis for gauging the fulfillment of therapeutic and (formal) educational aims.

11) The spheres of education and therapy are viewed as sharing a method designated here as "contrast." Contrast is deemed of great importance in the realm of perceived movement.

12) The perception of his situation by the individual is more important than that provided by an arbitrary externally imposed framework. The self-description technique affords a useful approach to the examination of personal constructions of events.

115 pages. $2.00. Mic 58-4451

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Abstract published by special arrangement with The Ohio State University.

VARIATIONS IN MUSCLE TENSION DURING MENTAL ACTIVITIES INVOLVING "EMOTIONAL" MATERIAL

(Publication No. 24,870)

Abraham Klein, Ph.D.
New York University, 1957

Adviser: Dr. Zygmunt F. Piotrowski

The purpose of this investigation is to study the comparative effects of mental activities involving material of varying affective quality on level of muscle tension. There is widespread agreement among a number of investigators that muscle tension is associated with mental effort. There is also a great deal of material -- clinical, theoretical, and experimental -- indicating that emotional experiences and peripheral bodily tensions (striate musculature) are intimately associated with one another. The question one may ask is whether this association is expressible during cognitive states. Would, for example, the

imagination or recall of emotional experiences be associated with increased muscular tensions? It is now known that the recollection of affectively toned ideas is capable of eliciting measurable physiological changes of an autonomic nature (respiratory rate, etc.). Can measurable changes of a somatic indicator (skeletal muscle) be elicited?

Briefly, the design consisted of continuous, simultaneous, bipolar electromyographic recordings of several muscle groups (right neck, right forearm flexor, right forearm extensor) under conditions of relaxation (lying on a cot) during such mental activities as imagination, recall, and listening to a recorded presentation of an interpersonal situation. For each mental activity there were two varying test conditions: one involving a relatively strong emotion, such as an "anger" experience (experimental condition); the other involving a relatively mild emotion, such as a "relaxing or calm" experience (control condition).

The design was based on repeated measurements of the same subjects. A sample of 24 non-neuropsychiatric male patients between the ages of 18 and 50 was drawn from a Veterans Administration Hospital and randomly assigned to six different orders of presentation.

After establishing a baseline level of activity, the test series was started. Each test period lasted approximately one minute not counting the time necessary for instructions. Between each period an intervening period of relaxation (no mental work) was used to avoid a build-up of tension from period to period. Before and after each test run, calibrations were made for all amplifications used. A post-experimental interview was conducted in order to obtain introspective data concerning the subject's mental responses.

The middle third of any test period (experimental, control, rest) was the sample of record for that period. From this sampling, alternate seconds were scored. The three largest deflections (peak to peak) in any scorable second were measured and converted to microvolts by reference to a standard calibration signal of known voltage. The unit score for any period was expressed as the ratio (in microvolts) of the immediately preceding rest period, multiplied by a constant.

Ratio scores yielded distributions with marked skewness which made necessary a logarithmic transformation of the data. These were then subject to analysis of variance. A significant F ratio (5% level) was obtained for the flexor muscle -- scores for the extensor muscle approached significance. Significant differences (5% level) occurred between experimental and control conditions for imagination and listening. In addition, comparisons of paired means (experimental-control) were made for all other muscles since the design was structured to elicit such comparisons. They indicated that experimental means tended to rank higher than control means. The largest differences were associated with imagination.

It was concluded that the association between emotional experiences and muscular tensions was expressible during cognitive states. Further lines of research were indicated, particularly the feasibility of using well-controlled laboratory studies dealing with other affects.

80 pages. $2.00. Mic 58-4452

COUNSELING: AN ANALYSIS OF THE PREDISPOSING VARIABLES. AN INQUIRY INTO THE PERSONAL AND SOCIAL ELEMENTS RELATED TO THE ACCEPTANCE OF COUNSELING.

(Publication No. 24,981)

Alice Schuster Korobow, Ph.D.
New York University, 1957

The purpose of this study was to examine and analyze the informational, cultural, experiential, and personal variables which may be related to a desire for counseling on the part of college students. It was hypothesized that knowledge of counseling, peer and family attitudes toward counseling, past response tendencies toward seeking assistance from others, socio-economic status, and specific personality traits were related to counseling seeking.

The experimental sample of sixty cases was drawn from a co-educational college population of 163 students enrolled at Brooklyn College. Two experimental groups were utilized, matched case by case for the following variables: age, sex, problem extensity measured by the Mooney Problem Check List, and counseling decision. The counseling-adient group (15 males, 15 females) expressed a desire for counseling. The counseling-avoidant group (15 males, 15 females) did not desire counseling. The statistical technique employed to demonstrate differences between the groups was the Wilcoxon matched-pairs signed-ranks test. A tetrachoric r was utilized to establish degree of relationship between the variables and counseling decision.

The instruments took the form of questionnaires in which the students' knowledge of counseling, perceived peer and family attitudes, past response tendencies, and socio-economic status were indicated. The personality categories were tested by the Jenkins "How Well Do You Know Yourself" Personality Questionnaire. The instruments were administered over a period of six weeks during the regular class period and the anonymity of the students was preserved.

Conclusions and interpretations:

1. The hypothesis of a relationship between knowledge of counseling and counseling-seeking is not confirmed. It is felt that intellectual learning probably must be accompanied by some emotional counterpart before it becomes a force in determining overt behavior.

2. The perceived attitudes of peers toward counseling is related to counseling decision. The two groups perceive an equivalence between their counseling decision and the attitude of the reference group. However, the obtained result is for the greater part due to the marked difference observed in the female sample. Cultural factors may account for the observed female's need to anchor her attitudes within the reference group.

3. The perceived family attitudes toward counseling are related to counseling decision. Counseling-adient and counseling-avoidant females perceive family attitudes as consistent with their own, although no significant difference is shown by the males. The female's need to claim a common attitude for themselves and their family appears to be in contrast with the male's culturally reinforced trait of independence.

4. The hypothesized relationship between past responses and counseling decision is confirmed. The two groups of females show no significant difference for this

variable. However, those males who have a past response tendency toward seeking assistance from others tend to be counseling-adient.

5. No support is found for the hypothesized relationship between socio-economic status and counseling-seeking.

6. The hypothesized relationship between counseling decision and personality is upheld. Emotional reticence is inversely related to counseling-seeking, for the entire group. Counseling-seeking individuals are characterized by general anxiety, depression, irritability and vocational insecurity. Counseling-adient behavior in the male sample is related to depression, general anxiety, irritability, hypersensitiveness, indecisiveness, and social insecurity.

This study demonstrates a need to view behavior as multi-determined. Although a segmental approach to counseling-seeking demonstrates a relationship between personal and social factors and counseling decision, a dynamic interaction of these factors is hypothesized. It is suggested that a hierarchy of behavioral determinants exists which, at each point of a gradient of problem severity, may assume different degrees of prepotency in their dynamic interaction in determining the final demonstration of overt behavior. 129 pages. $2.00. Mic 58-4453

A COMPARATIVE STUDY OF THE EFFECT OF INDUCED FAILURE, INDUCED SUCCESS, AND A NEUTRAL TASK UPON THE RETENTIVE PROCESSES OF ANXIETY AND NORMAL SUBJECTS

(Publication No. 25,025)

Arnold David Krugman, Ph.D.
University of Kentucky, 1952

To determine the influence of pathological anxiety and the effects of induced emotional states on retention, thirty-six neuropsychiatric male patients (non-psychotic, non-organic) manifesting various degrees of diagnosed anxiety, and thirty-six general medical male patients presenting no unusual anxiety symptoms, participated in the following experimental procedure.

Each of three sessions, conducted at half-day intervals, were divided into three phases: learning activity, interpolated activity, retention (relearning and recall) activity. For the learning activity three equated word lists were used, with the subject learning each list to a criterion of one perfect anticipation trial.

Following each learning phase, a different interpolated activity was presented. One activity was "neutral" in nature: subject read a cartoon book for a prescribed period of time. One activity was designed to induce feelings of failure: subject was presented with a Block Design test during which his performance was rated inadequate. One activity was designed to induce feelings of success: Block Design performance was rated superior.

Following each interpolated activity, subject was required to relearn the word list to the criterion of one perfect anticipation trial. Errors on the first relearning trial provided the recall score. Each subject, then, yielded three learning, three relearning, and three recall scores.

Findings:

Relearning performance for both Normal and Anxiety subjects was poorest after failure, best after success. For the Anxiety group, relearning means following each of the interpolated activities differed significantly from each other. The Normal group's mean relearning score following failure was significantly higher than the scores obtained following the neutral task and success. However, only trends toward differences were found following the neutral task and success.

For both groups recall scores were poorest following failure and best following success. Again for the Anxiety group significant differences were obtained between each of the interpolated tasks, while recall performance for the Normal group did not differ significantly following success and the neutral task.

Between-group comparisons revealed that Anxiety subjects fared significantly worse than the Normals in relearning and recall performance following failure, and in relearning following the neutral task. Significant trends in this direction were found in recall following the neutral task, and in relearning following success. No significant recall difference following success were noted between the groups.

The Anxiety group displayed significantly greater variability in relearning and recall performances following failure and the neutral task than did the Normals. Significant trends in this direction were noted in relearning activity following success, while no variance differences in recall were found between the groups following success.

Failure, for both groups, resulted in the greatest amount of relearning score scatter. However, some Normals exceeded the Anxiety group's performance level while some of the Anxiety group's scores could well have come from the Normal sample.

Relearning variances following success and the neutral task were reduced and similar for both groups, while, for the Normals, recall variances following each of the interpolated activities were minimal. The anxiety subjects differed significantly in recall variance following success as compared to both failure and the neutral task. Failure resulted in the greatest amount of variability, although it did not differ significantly from the neutral task.

FINAL NOTE

The results of this study provided us with a clearer picture of the anxiety patient's vulnerability to stress, and his ability to profit from success. Although definitive group differences were found, pointing both to the efficacy of the design as a means of producing the desired states and to the debilitating nature of anxiety, no absolute dichotomy is said to exist between the groups. Some similarity in functioning of anxiety in one group, and its absence in the other, furnished us with a variable whose effects on retention were measured objectively.

109 pages. $2.00. Mic 58-4454

A STUDY OF THREAT WITHIN THE PSYCHOLOGY OF PERSONAL CONSTRUCTS

(Publication No. 24,500)

Alvin Warner Landfield, Ph.D.
The Ohio State University, 1951

The hypotheses tested in the present investigation were derived from the Psychology of Personal Constructs, a theoretical approach recently advanced by Kelly.[1,2,3] The Psychology of Personal Constructs is a perceptual theory of personality which is primarily concerned with the individual. Within this theoretical framework, the individual is regarded as a process. By process, we mean that the individual is conceptualized as continually active in his attempts to make sense of his personal world. Instead of thinking of the individual as a passive unit which may be molded by the vicissitudes of the external environment, he is instead thought of as having a role in his own development, the emphasis being placed upon his interpretation of the environment rather than upon the environment per se.

In the role of an interpreter, the individual is much like the scientist functioning within his theoretical framework. The individual functions as the scientist does by attributing meaning and significance to events and by establishing expectancies of future events. The individual observes his own behavior and that of other people, sets up expectancies of his own and others' behavior on the basis of these observations, again makes behavioral observations, and as the result of them may modify his behavioral expectancies of himself and others, and even his personal theory of life.

Some individuals are very poor scientists, clinging rigidly to inadequate hypotheses, actively avoiding any consideration of their own behavior or that of other people, or misconstruing this behavior in order to support their personal theories. Other individuals are effective scientists, able to consider intelligently their own behavior and that of other people and to modify their expectancies and even theories in the interest of improved social interaction.

The individual's own theory is comprised of patterns of meaning which he places upon his personal world. These patterns of meaning which the individual attempts to fit over the realities of his world may be "explicitly formulated or implicitly acted out, verbally expressed or utterly inarticulate, consistent with other courses of behavior or inconsistent with them, intellectually reasoned or vegetatively sensed" (p. 3).[3] These patterns or categories of meaning of which we speak will be called personal constructs.

More explicitly, a personal construct is a concept formed by the individual through the process of both differentiation and generalization (i.e. by construing). For example, an individual may describe a friend as different from two other persons in that he is very energetic; yet, this friend may be similar in this respect to another person with whom the individual is acquainted.

The various personal constructs employed by an individual comprise his Construction System. This Construction System may be used by the individual to comprehend past, present, and future events, and, more importantly, events conceived as people and including oneself as well as other persons.

Since the Psychology of Personal Constructs is concerned with the individual, it is assumed that persons differ in their theoretical constructions. Two people cannot play the same role in the same event since "each experiences a different person as an external figure (i.e. each other)... [and] each experiences a different person as the central figure (i.e. himself)" (p. 41).[3] The term role may be interpreted to mean the way or ways in which an individual construes or gives significance to himself and to other persons.

The Psychology of Personal Constructs has provided the theoretical framework for the present study, which was designed to clarify the relationship between the individual's awareness of himself as a changing, developing organism and his feelings of personal threat. The term "personal threat" implies the study of frustration from an internal rather than an external frame of reference. Internal has reference to the meaning an event has for an individual. External has reference to something measurable apart from the individual, a situation or an object.

The Criterion

In the present study two kinds of threat are differentiated, threat from others and threat from self. These two kinds of threat comprise the experimental criteria. For the purposes of this experiment, threat from others was defined in terms of a person whom the subject wishes to avoid or whose behavior he would like to modify greatly. Non-threat from others was defined in terms of a person with whom the subject wishes to have contact and whose behavior he would not wish to modify greatly. Threat from self was defined in terms of oneself, with whom the subject is dissatisfied. Non-threat from self was defined in terms of oneself, with whom the subject is satisfied.

In the case of threat from others, our criterion consisted of two persons, one a threatening acquaintance of the subject and the other a non-threatening acquaintance. After the subject had identified these two acquaintances, he was asked to describe them. Our problem was to predict how the individual would describe the threatening and non-threatening persons.

Descriptions of other persons were of two kinds, Exemplification Role descriptions and Expectancy Role descriptions. Exemplification Role was defined as the construction an individual places upon another person. In other words, it is the individual's concept of the other person. Expectancy Role was defined as the construction an individual thinks another person places upon him. In other words, it is the individual's concept of the other person's concept of him. Restating our problem, concerning threat from others, we attempted to predict how the subject would describe the threatening and non-threatening persons in terms of Exemplification and Expectancy Roles.

In the case of threat from self, the criterion consisted of one person, the subject. Our problem was to predict whether or not the subject was threatened by himself. If it could be inferred from the subject's statements about himself that he was dissatisfied with himself, he was then considered as threatened by himself. If it could be inferred from the subject's statements about himself that he was satisfied with himself, he was then considered as not threatened by himself. It may be noted that self-dissatisfaction and threat from self are synonomous.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The Predictor

Now that we have discussed the criterion of the study, we are ready to deal with the predictor, which is movement. The term "movement" was suggested by the fundamental postulate of the Psychology of Personal Constructs —"A person's psychological processes evolve toward what he construes to be an optimal anticipation of events" (p. 29).[3]

Movement has been conceptualized as a change; this change is inferred from the difference between the ways in which a subject describes himself as he was in the past, as he is now, and as he may be or would like to be in the future. It should be understood that these descriptions of the past, present, and future were made from the locus of the present. The ways in which a subject described himself were called Self Roles. Self Role was defined as the construction an individual places upon himself.

Implied in the term movement is the concept of directionality; this directionality is used in the sense of change toward or away from something. For example, an individual sees himself in the past as having been uninterested in music, but in the present he sees himself as more interested in music. The directionality of change or movement is toward a greater interest in music. Since movement implies directionality and also is described in terms of Self Roles, the predictor has been entitled the directionality of Self Role Movement.

Movement, as we have employed it in this study, is seemingly inconsistent with the fundamental postulate of the Psychology of Personal Constructs in that it may be considered one measure of the evolving psychological processes of the individual.

General Statement of the Problem

Now that both the predictor and criterion have been introduced, the general experimental problem may be stated more fully: (1) To predict how a subject would describe the threatening and non-threatening persons in terms of Exemplification and Expectancy Roles from the directionality of his Self Role Movement. (2) To predict whether the subject was satisfied with himself or dissatisfied with himself from the directionality of his Self Role Movement.

Research Instruments

Two research tools were utilized: (1) The Role Construct Repertory Test, and (2) A Self Rating Scale. In the Role Construct technique, a subject writes the names of certain specified persons he knows, thirty in all, on separate cards. These cards, a name on each one, are dealt to the subject, three at a time, in certain combinations. As three cards (i.e. one sort) are dealt, the subject is asked, "In what outstanding way are two persons similar and different from the third?" From his response to this question, a rating scale may be created, a scale derived from the subject's descriptions of these people and expressed in his own terminology. This scale will be known as a Role Construct Scale. For example, the subject may state that two of the persons are gregarious and that the other is not. The terms "gregarious" and "not gregarious" are placed at either end of a nine-point rating scale. In order to stabilize the points on the rating scale, the subject then is asked to place two or three persons with whom he is acquainted at points on the scale, depending upon whether he sees the scale as dichotomous or dimensional.

Whenever the subject sees people as being generally one way or the other, relative to a Construct Category, his scale is considered to be dichotomous and only the poles of the scale are used for ratings. On the other hand, when the subject sees people in degrees (i.e. on a continuum), relative to a Construct Category, his scale is considered dimensional and all points of the scale may be used for ratings. In the former case, only two referent persons are placed on the scale, one at each end of the nine-point scale, and scale points two through eight are crossed out. In the latter case, three referent persons are placed on the scale, one at each end of the nine-point scale and one in the middle.

The Role Construct Scales which the subject created during the administration of the Role Construct technique constituted his Self Rating Scale.

Design of Experiment

The Role Construct Repertory Test was administered individually during one experimental session to fifty-four male and female undergraduate university students. The Self Rating Scale derived from the subject's responses to the Role Construct technique was administered individually during a second experimental session, at which time the subject was asked to (1) rate himself on his own Role Construct Scales as he would like to be six years from now if it were possible for him to be anything he wished; (2) rate himself as he feels he may really be six years from now; (3) rate himself as he feels he is now; (4) rate himself as he feels he was at some period during the past six years when he differed most from the way he is now; (5) think of a threatening and a non-threatening person and rate their Exemplification and Expectancy Roles; (6) answer two questions from which it may be inferred that he is either satisfied with himself or dissatisfied with himself.

Results and Their Interpretation

Threat from others: We found that a highly significant relationship exists between Self Role Movement of an individual and the way he construes threatening and non-threatening people in terms of Exemplification and Expectancy Roles. More explicitly stated, the threatening other person is seen by an individual as being more like himself as he was in the past, or is now but no longer wants to be, than the non-threatening person. Also, the threatening other person is seen by an individual as expecting him to be more as he used to be, or is now but no longer wants to be, than the non-threatening person. Stated in another way, it is possible to predict successfully those persons who are threatening and non-threatening to most subjects from the directionality of their Self Role Movements.

In terms of the Psychology of Personal Constructs, these findings may be interpreted further to mean that the threatening person is placed by the threatened individual in the unique position of being able to reverse the individual's direction of movement, to interrupt his movement or at least to place him under additional pressure to resist such modification of his movement.

Threat from self: We did not find a relationship between changes in the directionality of Self Role Movement and an individual's self-satisfaction or self-dissatisfaction.

In addition to the testing of the primary hypotheses (i.e. the relationship between movement and threat), we also tested an exploratory hypothesis. We found that the number

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of Role Construct Scales which an individual checks as being areas in which he is mixed up about himself is a fair predictor of self-satisfaction and self-dissatisfaction. The results of this hypothesis support the notion that one's constructions at a high level of abstraction are internally consistent with similar constructions at a lower level of abstraction. 154 pages. $2.05. Mic 58-4455

1. Kelly, G.A. "Psychological Approaches to the Management of Patients." Text of speech presented at the U.S. Veterans Administration Hospital, Houston, Texas, March 20, 1951.

2. Kelly, G. A. "The Psychology of Personal Constructs." Text of speech presented at the U. S. Veterans Administration Hospital, Houston, Texas, March 20, 1951.

3. Kelly, G. A. "The Psychological Construction of Life." Unpublished results.

Abstract published by special arrangement with The Ohio State University.

THE EFFECT OF ROLE PLAYING ON ROLE PLAYING ABILITY AND INTERPERSONAL ADEQUACY

(Publication No. 24,876)

Carola H. Mann, Ph.D.
New York University, 1957

Adviser: Dr. Avrum Ben-Avi

This study was designed to investigate the effects of training in role playing on role playing ability, interpersonal adequacy and realism of self-perception. The following hypotheses were tested: 1. Subjects receiving training in role playing show a significant increase in role playing ability; 2. subjects with role playing experience are perceived by others as increasing in interpersonal adequacy; 3. subjects with role playing experience perceive themselves as increasing in interpersonal adequacy; 4. subjects with role playing experience increase in realism of self-perception.

Ninety-six subjects were selected randomly from the graduate course Education and Personality, given at Teachers College, Columbia University during June 1956. After being stratified for race and sex, the subjects were randomly assigned to groups of eight. These groups met during three weeks for 12 one-hour meetings in addition to a general lecture in which all students met together. During the group meetings six groups were engaged in role playing; three groups, designed to control for effects of group interaction, met in leaderless discussion groups; three groups (study groups), designed to control for effects of task oriented group interaction, discussed assigned readings.

At the third and at the last group meeting all subjects rated fellow group members and themselves on a five point scale on criteria associated with individual prominence, group goal facilitation, group sociability and on general adjustment. Interpersonal adequacy was defined in terms of these criteria. Role players also rated all group members including themselves on quality of role performance.

At the beginning and at the end of the experimental period all subjects participated in a situational test. For this test they were assigned randomly to groups of eight which were different in composition from the daily groups. Each group met for 15 minutes to discuss "The Adequacy of Grades as a Measure of Ability in Graduate Study." Trained observers rated the subjects on quality of role performance in the situational test; judges analysed tape recordings of these tests for number of roles taken.

Hypothesis (1) was tested through self-ratings; through ratings made by other role players, by members of the audience, by judges evaluating tape recorded role playing sessions, by observers in the situational test and by judges tabulating number of roles taken in the situational test. Hypothesis (1) was found to be supported in all its aspects.

To test hypothesis (2) the average rating given to each group member on the criteria associated with interpersonal adequacy was computed at the beginning and at the end of the experiment. It was found that members of role playing groups perceived each other more interpersonally adequate at the end of the experiment than discussion group members. Role playing and study groups did not differ significantly in increase in interpersonal adequacy as perceived by others.

To test hypothesis (3) self-ratings on the criteria associated with interpersonal adequacy obtained at the beginning of the experiment were compared with those obtained at the end. It was found that role players came to perceive themselves significantly more interpersonally adequate than discussion group members. Role playing and study groups did not differ significantly in increase in self-perceived interpersonal adequacy.

Hypothesis (4) was not substantiated by the data.

It was concluded that role playing activity increases role playing ability and interpersonal adequacy as perceived by others and by the self more effectively than discussion group activity, but not more effectively than study group activity. Additional data indicated that changes in the study groups were limited to the daily group situation and were not noticeable to outside observers.

91 pages. $2.00. Mic 58-4456

H. TAINE: THE NEUROTIC

(Publication No. 25,028)

Laura Jean McAdams, Ph.D.
University of Kentucky, 1949

Hippolyte-Adolphe Taine (1828-1893), the theorist of Naturalism and, in general, of literature with scientific intentions or pretentions, has had a tremendous influence since 1865. He was a poète-logicien with a divided mind and troubled soul, tortured by illness and an anxiety neurosis. In view of present day knowledge of psychiatry and psychology, this modern mental study will clearly show the progressive development of Taine's illness and anxiety neurosis and the ultimate results of these on Taine himself, his doctrine, and his work.

Summary of Case History: Anxiety neurosis manifested as a result of profound feelings of insecurity and inferiority, illness, and frustrations in his home life,

sex life, emotional, economic, professional, philosophical, political, and religious conflicts. Feelings were deep-seated, apparently had roots in early childhood. Had always been fearful and apprehensive. Last apprehensions had become more intense because of unstable politics and war in France, his long political work: Les Origines de la France contemporaine, his fear of not being able to complete it before his death, and his ultimate failure in politics after the insufficiencies of a moral solution.

In conclusion, documentary evidence proves that illness and an anxiety neurosis affected Taine himself and his work to such an extent that they caused the following:

1. His taste for speculative life;
2. His change from speculative intellectualism to practical action in ethics, politics, and history;
3. His pessimism;
4. His transposing into laws and theories the peculiarities of his own weak temperament tortured by an anxiety neurosis, thereby making his doctrine that of a neurotic patient and his picture of the structure and activity of the brain in De l'Intelligence that of his own functionally disturbed central nervous system;
5. His worship and veneration of superabundant, physical vitality;
6. His ascetic will (found in his works in the form of a demonstrative tone);
7. His change of style.

Thus, Taine, the man with his powerful will, brilliant mind, lovable personality, high probity, and earnest endeavors for the benefit of mankind, towers above his pessimistic philosophy. 316 pages. $4.05. Mic 58-4457

LEARNING WITHOUT AWARENESS AND ITS RELATIONSHIP TO INSIGHT AND THE HYSTERIC-OBSESSIVE DIMENSION

(Publication No. 24,877)

Gedon Joseph Medini, Ph.D.
New York University, 1957

Adviser: Professor Robert I. Silverman

The investigation of learning without awareness has raised many questions. Studies have shown that the rate of learning varies with individuals, as does their ability to achieve insight into the variables that influence their behavior. The question of the relationship between learning without awareness and insight has been studied with different results. Postman (16) found that those who attained insight, learned more rapidly on a level without awareness. Eriksen (4) found no relationship between insight and learning without awareness. The present study investigated the relationship between speed of insight and learning without awareness in a situation of verbal conditioning patterned after Taffel (26). The second problem investigated related to the effect of individual differences on the achievement of insight. From clinical and theoretical considerations, it was predicted that obsessive individuals would be superior to hysteric individuals in the ability to become aware of the factors which influence their verbal behavior. A measure of this capacity was obtained by calculating the interval (in terms of trials) between the onset of conditioning of verbal behavior and the point where insight was verbalized. This interval was referred to as the unconscious interval (UI). It was predicted that the UI of hysterics would be significantly greater than that of obsessives.

The subjects consisted of males who were selected from the general medical wards of a large V.A. hospital. Two groups of 30 Ss matched for intelligence, were selected on the basis of the Hy and Pt scales of the MMPI. Ss were presented with 3 x 5 unlined cards, on each of which was a common verb, and four pronouns below: I, He, We, They and were instructed to make up a sentence for each card, beginning with one of the pronouns and including the verb. After establishing an operant level of 20 trials, E said "good" after each sentence that was begun with a predetermined pronoun. When learning began, each S was asked "When do I say 'good'?" This was repeated at intervals of ten trials until S verbalized insight, or until the end of 200 trials.

The results indicated that "good" was an effective reinforcement. The learning curve of the total sample rose significantly when compared with operant level.

There was no significant difference between the learning rate of the fast insight group (Ss with a UI of four or less) and slow insight group (Ss with a UI of five or more). Thus no relationship between speed of conditioning and insight was found.

The results indicated a relationship between the personality variables and rate of learning. The Hy group learned at a faster rate than the Pt group. This was felt to be due to the difference between the groups in terms of characteristics of dependency.

The hypothesis that predicted a relationship between personality and insight variables was not clearly supported by the results. The difference in UI was significant at the .05 level when computed in terms of blocks. ($U = 2.04$, $p < .05$). When the data were analyzed in terms of the conditioned responses, the difference was not significant at the .05 level. ($T = 1.71$, $p > .10$).

Clinical implications were discussed in terms of the importance of learning without awareness as it applies to interpersonal influences such as exist in clinical interviews. Implications for research into the variables that influence the conditioning of verbal behavior were pointed out. 65 pages. $2.00. Mic 58-4458

A FIELD STUDY OF A PSYCHIATRIC AIDE APPLICANT GROUP AT A STATE MENTAL HOSPITAL

(Publication No. 25,029)

David Hamilton Orr, Ph.D.
University of Kentucky, 1950

The primary purpose of this research was a field study of a psychiatric aide applicant group at a state mental hospital. The research was the result of an attempt to find objective criteria for judging applicants for employment. The method was to investigate the personal history and personality of the individuals in the group as the

necessary preliminary to establishing realistic prerequisites for employment.

The methods utilized for gathering the data for the investigation were chosen because of their adaptability to the employment situation. Thus, an application form was filled in by the psychologist and the procedure was directed toward eliciting the necessary information for employment and for the evaluation of the group. The Kent Emergency Intelligence Test was utilized because an indication of level of intelligence was desired and the Rorschach Ink Blot Procedure was administered to each applicant in order to evaluate his personality structure.

The method of interviewing the applicant was carefully examined and the best methods for eliciting information were discussed.

All data from the personal history form, the Kent Emergency Intelligence Test and the Rorschach Ink Blot Procedure of one hundred applicants was utilized in the study. Four sub-groups were utilized and the division was in terms of previous mental hospital experience and sex. Records from twenty-five males without experience, twenty-five females without experience, twenty-six males with previous experience and twenty-four females with previous experience were taken randomly from files accumulated during a nine month period.

The data from these sub-groups was analysed statistically and sub-group similarities and differences were calculated. Whenever data from other studies were available, the data from the applicant group was compared to the material from other studies. This was done separately for the personal history data and the Rorschach data.

An examination of the duties of the psychiatric aide on the ward was made. It was found that many tasks necessitated the ability in the aide to read and write observations and directions clearly. It was suggested that an eighth grade educational minimum should be established. However, the survey of the duties of the aide showed that ability to adjust to the patient was the most important part of his work. Examples of how this applied to the work of the aide were given and six illustrative examples of applicants who had been employed were cited.

The conclusions drawn in the study indicated that the average applicant was not a satisfactory aide. There should be mitigating factors in either the personal history or the Rorschach summary to raise him above the level of the average applicant in order to qualify him for consideration for employment. The choice of the aide was found to depend upon the evaluation of the totality of his qualifications. No single feature may be considered conclusive but all must be evaluated in estimating his eligibility. Previous mental hospital experience was not necessarily a mitigating factor but had to be evaluated in relation to all other qualifications.

It was recognized that many aides are employed who will become only partially satisfactory. Because of this, it was suggested that a training program be initiated which would give the aide some understanding of the psychotic manifestations which he observes daily. It was felt that the more fully the aide understands his duties and his relationship to the patient, the more satisfactory he will be as an aide. 205 pages. $2.70. Mic 58-4459

EXPERIMENTAL PSYCHOTHERAPY: THERAPISTS' RESPONSES UNDER THREAT AND NON-THREAT

(Publication No. 24,481)

Henry Julius Paar, Jr., Ph.D.
George Peabody College for Teachers, 1957

Major Professor: Julius Seeman

The general purpose of this study was to develop and demonstrate a methodology for the investigation of psychotherapists' behavior. Within that framework, two directions of inquiry were pursued. The first concerned the experimental investigation of a hypothesis, and the second concerned the construction of a scale to measure the effectiveness of therapists' responses. A review of studies illustrating methodology, instrumentation, and effective therapist response revealed little pertinent research on this joint problem.

Deduced from one of Roger's propositions regarding behavior, the hypothesis stated that in a setting of perceived threat, therapist responses to client statements would be less effective than responses offered in the absence of threat. Subjects for the experiment were 16 psychologists and psychiatrists who had had training in therapy and an average of some 224 hours experience in its practice. They were required to respond individually and in their typical therapeutic way to the statements of clients on three specially recorded tapes. All tapes were taken from actual therapy interviews but were altered to retain only the clients' statements and periods of silence where the original therapists' responses had been. One tape was used exclusively for practice by all subjects, while the other two provided the stimulus material for the experiment.

Two basic conditions comprised the experiment, namely, non-threat and threat. In the non-threat condition, each subject faced two tape recorders while alone in a room. One recorder played a tape bearing a client's statements, and the other recorded those statements and the subject's responses to them. In the threat condition, each subject followed the same procedure with the other tape while the experimenter also remained in the room and endeavored to threaten the subject by introducing evaluative, authority-figure stimuli.

To determine whether threat actually was perceived, four physiological measures of tension were obtained from each subject, one following the instructions for each condition and one at the conclusion of each condition. To control the effect of differing stimulus material, the two tapes were counterbalanced. Similarly, to control the effect of the order of presentation of threat, threat and non-threat were counterbalanced in sequence. These last two variables, combined with the effect of threat, brought the total number of conditions to eight. The resultant verbal responses, evaluated by the scale developed in this study, were tested for significance by a complex analysis of variance.

The scale for measuring the effectiveness of therapists' responses was constructed according to the method of equal-appearing intervals. Seven therapists provided a pool of 266 responses to 38 client statements. These were sorted by 24 experienced therapists into seven piles along a continuum of defined effectiveness. Graphic analysis of the sortings revealed 125 items which had low

ambiguity value, covered the continuum, and grouped around seven scale points. The internal consistency of the scale and inter- and intra-judge reliabilities in its use were found acceptable. Face validity, logical validity, and one kind of empirical validity indicated that the scale measures what it should measure.

Evaluated by this scale, the verbal responses of 13 of the 16 experimental subjects scored lower under threat than under non-threat. Although this was significant by a sign test, and the physiological measures demonstrated that threat was perceived, the more sensitive analysis of variance test showed no significant differences between conditions. That is, the effectiveness of the subjects' responses remained the same whether obtained under threat or under non-threat. As predicted, no significant differences were found between the tapes employed, the order of presentation of threat, or the interactions. The conclusions and implications from these findings and the scale are discussed. 111 pages. $2.00. Mic 58-4460

A STUDY OF SOME GENETIC BEHAVIORAL CORRELATES OF HUMAN MOVEMENT RESPONSES IN CHILDREN'S RORSCHACH PROTOCOLS

(Publication No. 24,881)

Anneliese Riess, Ph.D.
New York University, 1957

Adviser: Isidor Chein

This study has been concerned with the validation of Rorschach human movement responses by relating them to forms of observable behavior. In accordance with Rorschach's empirical observations human movement responses (M) were conceptualized as indicators of reflective forms of behavior which were expected to influence overt behavior tendencies in a definite predictable direction. This direction would be characterized by the delay of action due to reflection for the purpose of a more successful or rewarding outcome. In terms of developmental psychology, increasing internalization is believed to lead to more controlled, socially acceptable and planful behavior. In psychoanalytic terms, thought is interposed between the impulse and its execution and therefore serves to delay action and save energy.

The almost complete absence of M in preschool children and its increasing frequency in six and seven year olds are parallelled by the negligible existence of reflective behavior in the preschool child and its increasing prominence in the young school child. It was assumed that these known developmental facts were related to each other. Therefore predictions were made about the behavior differences between children with M responses (M children) and those without M responses (no-M children), all other factors being equal. M children were expected to show more of those forms of behavior which are associated with a greater potential for reflection than no-M children. Specifically, it was hypothesized that M children I) would be less motorically active, II) more planful, III) more able to delay need gratification, and IV) have a more complete body image than no-M children.

Of sixty middle class children, six and seven years old, thirty gave M responses and thirty did not. The groups were equated for age, sex, intelligence, number of Rorschach responses and color responsiveness. All children were subject to the identical five "play" situations.

Hypothesis I was confirmed. In accordance with reported research on adults, M children displayed greater motor restraint than no-M children.

Hypothesis II had to be rejected. In contradiction to all related research, both groups of children showed the same extent of planfulness and motor control.

The apparent inconsistency of the children's behavior has been related to their incomplete personality structure. The absence or presence of the adult seems to have had the effect of a critical variable. The "psychological" absence of the adult in the free play (hypothesis I) allowed the children to use whatever internalized controls they had acquired. The "active" presence of the adult in the situations testing hypothesis II seems to have imposed on the no-M children external controls which made them behave the same as the M children.

The assumed greater independence of the M children from outer controls was ascribed to their having progressed further in social maturity by introjection of and identification with parental demands. In the socially less mature no-M children the absence or presence of the authority figure plays a more differential role. It seems to induce vacillation between relative impulsivity in one and more restrained behavior in another situation.

A plan for the experimental testing of this speculative interpretation of the results of hypotheses I and II has been suggested.

Hypothesis III had to be rejected but retesting under different conditions was proposed.

Hypothesis IV was not tenable in the form in which it was tested.

In addition to a complete Rorschach test all children were given the Barron Ink Blot Form Test. Correlations between Rorschach M and Barron Threshold were found to be very high. 120 pages. $2.00. Mic 58-4461

RIGIDITY IN THE AGED

(Publication No. 24,924)

Ethel Ann Shields, Ph.D.
Northwestern University, 1957

Popular opinion has been that aged individuals are more rigid than younger individuals. This opinion has not been empirically checked in systematic fashion, however, and the present study was designed as an investigation of certain aspects of rigidity in the aged. Rigidity was here defined as the failure to alter cognitive or ideational behavior appropriately when a new situation required that the individual change habitual modes of response. These habitual response patterns consisted of old, over-learned habits acquired by the individual in the process of learning to adapt to the culture.

The Ss consisted of two groups of 36 women each, who volunteered their services for this study. The Aged Group resided in a private home for aged women; the Younger Group comprised women in the surrounding communities, who were living in their own homes. The major variable

on which the groups differed was chronological age; members of the Younger Group were a generation (30 years) younger than members of the Aged Group. The groups were matched on the basis of sex, marital status, and comparable cultural and socio-economic backgrounds. When compared to the general population, both groups were superior in intelligence and socio-economic status.

Four objective measures of ideational rigidity and a brief measure of verbal intelligence were administered individually to all members of both groups. In addition, each member of the Aged Group filled out an inventory designed to measure attitudes toward the self, the environment, and others. An index designed to measure the degree of mental and personality changes that are indicative of encroaching senility was filled out for each individual in the Aged Group by a staff member of the private institution.

The following results were obtained:

1. The Aged Group scored significantly higher than the Younger Group on the measures of ideational rigidity. The first major hypothesis was clearly confirmed.

2. Differences in rigidity between the two age groups remained highly significant after the effects of intellectual functioning were statistically removed. Although this finding negated the second major hypothesis, it demonstrated that chronological age was a significantly greater variable in degree of rigidity than was present level of intellectual functioning.

3. Aged individuals who manifested signs of encroaching senility did not evidence a greater rigidity than aged individuals who did not manifest such signs, regardless of chronological age. Although this finding was contrary to the third hypothesis, it supported the findings relevant to the second hypothesis.

4. Aged individuals whose attitudes toward aging were less adaptive evidenced no greater rigidity than aged individuals whose attitudes were more adaptive. This finding was consistent with the fourth hypothesis.

Because of the particular qualities of the aged population that was investigated, it appears warranted to extend the finding that aged individuals manifest greater ideational rigidity than younger individuals to include other populations of aged people not represented in this study. The advisability in exercising caution, however, in generalizing the other findings to conditions beyond the scope of this study was discussed in terms of the limitations of the specific measures employed. Suggestions were made for future studies in ideational rigidity in the aged, and specific improvements in methodology were recommended.

113 pages. $2.00. Mic 58-4462

THE CONTRIBUTION OF INTELLIGENCE, INTERESTS, TEMPERAMENT AND CERTAIN PERSONALITY VARIABLES TO ACADEMIC ACHIEVEMENT IN A PHYSICAL SCIENCE AND MATHEMATICS CURRICULUM

(Publication No. 24,192)

Solomon Stone, Ph.D.
New York University, 1957

The Problem

The purpose of the investigation was to determine the contribution of intelligence, interests, temperament, and certain personality variables to the academic achievement of a group of successful physical science and mathematics students. The specific problems in the study were:

1. To determine whether a linear or non-linear relationship existed between the criterion and each of the twenty-five independent variables.
2. To determine the nature and significance of the relationships between the criterion and each of the independent variables on which the regression of the criterion was linear.
3. To discover those variables which gave a maximum multiple coefficient of correlation with the criterion.
4. To compute a multiple regression equation from which the criterion could be predicted with the highest precision of which the given list of variables was capable.

Procedure

The American Council on Education Psychological Examination, the Kuder Preference Record, the Thurstone Temperament Schedule and the Minnesota Personality Scale were administered to fifty male college seniors who were majoring in the physical sciences and mathematics.

The criterion measures were the students' four-year grade-point averages in physics, chemistry and mathematics.

The data were treated in the following manner:

The regression of the criterion on each of the twenty-five independent variates was subjected to the Chi-Square Test for Linearity of Regression.

Pearson r's were calculated for the criterion and each of the independent variates on which the regression of the criterion was linear.

The Wherry-Doolittle Test Selection Method was used to select the most valid battery of tests for predicting criterion scores.

The multiple regression equation in score form for the tests selected by the Wherry-Doolittle Method was calculated.

Results

The Sociable and Economic Conservatism scales were dropped from the list of independent variates because the regression of the criterion on each of these variables departed significantly from rectilinearity.

Four of the twenty-three obtained r's differed significantly from zero correlation. High scores on the criterion were associated with high scores on the Quantitative, Linguistic and Total intelligence scales and with low scores on the Mechanical interest scale.

The most valid battery of tests for predicting success on the criterion consists of the Total intelligence, Mechanical interest, Morale, Stable and Active scales ($\overline{R}$ = .575).

The multiple regression equation in score form is

$$\overline{X}_c = .014X_1 - .023X_3 + .011X_{18} - .028X_{16} - .031X_{12} + .627$$

where X_1, X_3, X_{18}, X_{16} and X_{12} refer to scores on the Total intelligence, Mechanical interest, Morale, Stable and Active scales respectively. The standard error of a criterion score predicted from the regression equation is .516.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Conclusions

Zero-order correlation analysis partially supports the basic hypothesis that certain intellectual, interest, temperament and other personality variables contribute significantly to academic achievement in a physical science and mathematics curriculum.

In general, tests of non-intellectual factors show practically no correlation with four-year grade-point averages in the physical sciences and mathematics.

Multiple correlation analysis supports the basic hypothesis that a weighted combination of certain intellectual, interest, temperament and other personality variables contributes significantly to academic achievement in a physical science and mathematics curriculum.

The study data are at variance with Garrett's conclusion that, "Interest tests and personality tests add very little if anything to intelligence as a predictor of college success."[1] The addition of four non-intellectual variates to an intellectual variate more than doubled the latter's efficiency in predicting criterion scores.

The nature of the findings limits prediction to groups. Results need to be validated in further studies before they can be applied to populations different from the one in the present investigation.

The greater part of the variation in students' four-year grade-point averages in the physical sciences and mathematics is still unaccounted for by the prognostic instruments employed in the present investigation.

140 pages. $2.00. Mic 58-4463

1. H. F. Garrett, "A Review and Interpretation of Factors Related to Scholastic Success in Colleges of Arts and Science and Teachers Colleges," Journal of Experimental Education, 18 (1949), p. 128.

THE CONSISTENCY OF CONTROL FUNCTION IN NON-PATIENT AND PATIENT POPULATIONS: AN EVALUATION OF INTRA-INDIVIDUAL CONTROL IN THE SELF, THE EGO, AND BEHAVIOR IN NON-HOSPITALIZED PERSONS AND IN GROUPS OF PATIENTS DIAGNOSED AS PARANOID SCHIZOPHRENIA

(Publication No. 24,987)

Alvin Roy Talkoff, Ph.D.
New York University, 1957

The Problem

This study is concerned with the relation between perceptual ego control and control within the self. The first sub-problem is to determine and compare ego perceptual control and control in self for a non-patient group. The second sub-problem is to determine and compare ego perceptual control and control in self for a newly hospitalized paranoid schizophrenic group. The third sub-problem is to determine and compare ego perceptual control and control in self for a group of about-to-be discharged paranoid schizophrenic patients. The last sub-problem is an intergroup comparison of the data obtained in the first three problems.

Methods and Procedures

The results are based upon study of three groups of twenty-five male subjects each who were equated for age and were of average intelligence or higher. Both patient groups were obtained at Mayview State Hospital, Mayview, Pennsylvania. Non-patients were obtained among hospital employees and service club members.

Each subject was evaluated for five areas of control function through use of a test battery including the Rorschach Technique, Human Drawings, and a Behavior Control Scale. Intelligence was evaluated by means of a short form of the Wechsler-Bellevue Intelligence Scale, Form I. Personality areas evaluated were behavioral control, perceptual ego control and ability to differentiate among selected roles within the self.

The data were scored and subjected to statistical analysis. Measures of control for each group were examined and compared through analysis of variance and t techniques. Comparisons among the groups were made for each test and for group patterns by means of analysis of variance, t techniques, and Chi-Square. Additionally sub-sections of the Rorschach data scored according to Beck, and the differences among drawings re-rated on a three point differentiation scale were examined. Comparisons among the subject groups for each personality test and for group pattern were performed by means of Chi-Square.

Results

Original evaluation techniques were of low differentiating value, although other scoring techniques were able to differentiate the subject groups. Reliability of judgment of difference between pairs of drawings was consistently high.

The pattern of control found in the non-patient group was suggestive of adequate role differentiation, lack of ego guarding and adequate behavioral control. Both patient groups exhibited a pattern indicative of role confusion, ego perceptual constriction, and loss of behavioral control. About-to-be discharged patients gave evidence of reconstituted ego function and decreased symptomatology.

The groups of subjects differed significantly in control function in behavior, aspects of ego control, and in ability to differentiate among roles. Non-patients exhibited greater flexibility than either patient group in all areas of personality examined. The about-to-be discharged patients exhibited greater behavioral control than did newly-admitted patients. The former group tended to exhibit less self-concept flexibility and less ego rigidity than did the newly-admitted patients.

Conclusions

Control function was revealed as a complex pattern varying significantly with the group. The hypothesis that the groups would differ significantly in control function was upheld. A second hypothesis that the non-patients would exhibit significantly greater control than either patient groups was not upheld. The third hypothesis that the to-be-discharged patients would exhibit greater control than the other patient groups was not upheld. The non-patient control pattern was suggestive of flexible ego function and role differentiation. The new-patient pattern was indicative of role confusion, ego constriction, and loss of behavioral control. The rehabilitated patients gave evidence of reconstituted ego function and decreased symptomatology. 170 pages. $2.25. Mic 58-4464

SOME GRAPHOMOTOR FEATURES OF THE BENDER VISUAL-MOTOR GESTALT TEST IN RELATION TO DELINQUENT AND NON-DELINQUENT WHITE ADOLESCENT MALES

(Publication No. 24,988)

Clarence A. Tripp, Ph.D.
New York University, 1957

In this study, an attempt was made to establish and cross-validate some of the graphomotor features which discriminate between delinquency and non-delinquency in the Bender-Gestalt performances of white adolescent males.

All subjects used in this investigation were between 15 and 20 years of age with less than half a year between the mean ages of the two groups. The experimental and control groups were equated in intelligence, educational level, national origin and socio-economic status.

The delinquents, all of whom were charged with felonious crimes, were obtained from the Prison Ward of Kings County Hospital. The non-delinquents were obtained from two New York City community houses.

The experimental and control groups consisted of 50 Bender-Gestalt records each. Half of the records of each group were combined to form an hypotheses-generating sample. The remaining half formed a cross-validation plan.

The two halves of the hypotheses-generating sample were observed for differences which might significantly discriminate the delinquents from the non-delinquents. Table I lists the 15 features that were generated.

TABLE I

1. Collision
2. Dot Crudity
3. Closure Problem
4. Loopy or Springy Vertical in Figure #6
5. Placement of the First Figure
6. Disturbed Line Quality
7. Dot Retrogression
8. Angle Overshoot
9. Phase Shift Vertical in Figure #6
10. Page or Figure Turning
11. Bleed-Off
12. Pressure (high or low)
13. Margin Hug
14. Compression-Expansion
15. Parallelism-Perpendicularism (in Figure #7)

The randomly mixed hypotheses-generating sample was then submitted to each of four judges who were clinical psychologists experienced with, and especially interested in, the Bender-Gestalt test. Each judge scored each feature as present or absent on each record of the hypotheses-generating sample. Each of the two judges who showed the least number of disagreements with the other three were chosen as best; their scores were averaged to find the number of times a particular test-feature was scored for the delinquent and non-delinquent portions of the sample. On each of the 15 features, tests of significance were applied (chi square and Fisher's factorial method of finding exact probabilities). The first 12 features listed in Table I were found to discriminate between delinquents and non-delinquents at the 10 per cent level of confidence, or better.

For cross-validation, the two chosen judges were asked to rate each of the 12 surviving test-features as present or absent on each of the 50 records of the cross-validation sample. Their scores for the delinquent and non-delinquent portions of the sample were compared as before, except that significance was demanded at the five per cent level of confidence or better.

The results indicated that the first six of the original 15 measures as listed in Table I significantly differentiated delinquents from non-delinquents.

In a section entitled Problems of Diagnosis or Prediction, statistical evidence is presented to show why even very powerful discriminators cannot be safely used to diagnose individual delinquency. The true value of experimentally established discriminators lies in their connotational use.

The results of this study point to delinquents' impulsiveness and problem of self-control. In other instances the guardedness and over compensation with which delinquents struggle to control their actions results in a compulsive over-doing of the concrete elements in a task. Sample theoretical applications are presented for each of the discriminators which proved significant.

103 pages. $2.00. Mic 58-4465

A COMPARATIVE STUDY OF SELECTED PSYCHOLOGICAL AND PHYSIOLOGICAL MEASURES TO EVALUATE PSYCHIATRIC CONDITIONS

(Publication No. 24,990)

Angelo A. Vitanza, Ph.D.
New York University, 1957

The purpose of this study was to obtain the relations between selected psychiatric, psychological, and physiological measures of psychiatric conditions, and to determine whether the psychological or the physiological measures were more valid in reflecting psychiatric conditions.

In order to resolve this problem, it was necessary to ascertain the relation between psychiatric measures and psychological measures, both disciplines using the factors Depression, Anxiety, Tension, and Excitement as psychiatric variables. It was also necessary to ascertain the relation between psychological measures of these variables, and the physiological measures of psychiatric patients. The psychological measure was the Bender Visual-Motor Gestalt Test and the physiological measures were the Pneumograph, the Psychogalvanometer, and the record of pulse beats as measured by the Electrocardiograph. A third problem was to ascertain the relation between psychiatric judgement and the physiological measures. Finally, it was necessary to ascertain which of the measures was most valid in evaluating psychiatric patients.

A random sample of 51 male schizophrenic patients at Creedmoor Institute, Creedmoor State Hospital was selected. The patients ranged in age from 17 to 40 years and were in otherwise good health.

The procedure consisted in having each of the patients tested with the three instruments. These data were collected for the specific purpose of establishing physiological norms for each individual. The subjects were tested

individually for a sixty-second period, and norms were recorded of their physiological reactions.

At the end of the sixty-second period, the instruments were detached from the patient, and he was asked to draw the Bender Visual Motor Gestalt Test. When he was through, the instruments were again attached to him, and he was shown each of the nine cards, one at a time, for nine thirty-second periods, these data being compared to the previously obtained norm.

Three clinical psychologists evaluated the patients' Bender designs on a five-point scale from "one" to "five," "one" being reserved for those patients not demonstrating any clinical evidence of Depression, Anxiety, Tension, or Excitement, and "five" allocated to those patients who were disabled in any of these four areas. The psychiatrist also evaluated these patients independently using the same scale.

The psychological judgements were correlated with the psychiatric judgements and with the physiological deviations demonstrated by the patients. The psychiatric judgements were similarly correlated with physiological deviations demonstrated by the patients.

The results showed that the psychologists' and the psychiatrist's judgements correlated in all four areas in a low but significant manner. The psychological measures of the variable Tension correlated with Pneumograph variations and pulse beat. The psychological variable Excitement correlated negatively with Psychogalvanometer readings. Psychiatric judgement of Anxiety, Tension, and Excitement correlated with Pneumograph deviations. Psychiatric judgement of the variables did not correlate with any Psychogalvanometer deviations. The psychiatric variable of Anxiety was the only one correlating with the Electrocardiograph for pulse beat.

In conclusion it was found that there was a consistent, although low, significant relationship between psychiatric measures of the four variables, and psychological evaluation of the same variables. The relationship of psychological judgement to physiological conditions was found only in the variable of Tension when evaluated by pulse beat deviations; the psychological variable of Excitement was found to correlate with Psychogalvanic readings. Psychiatric judgement of Anxiety, Tension, and Excitement was found to relate significantly with Pneumograph readings and the psychiatric variable of Excitement with pulse beat. It is concluded that it is difficult to assess with any degree of precision which measure is most valid in evaluating psychiatric conditions.

77 pages. $2.00. Mic 58-4466

AN INVESTIGATION OF CERTAIN PSYCHODYNAMIC ASPECTS OF THE PERSONALITY OF INDIVIDUALS WHO HAVE SUFFERED MANIC AND DEPRESSIVE ATTACKS

(Publication No. 21,722)

Ruth R. Wechsler, Ph.D.
New York University, 1957

The purpose of this study was to investigate and compare, through the use of psychological projective techniques, certain psychodynamic aspects of the personality of individuals who had suffered psychotic attacks of either mania or depression and who at the time of investigation were in remission of their symptoms.

Certain personality clusters were sought that would identify both the manic and depressive subjects. These it was hypothesized would include combinations of the following characteristics: ambivalence of attitude toward love objects; repression of hostile impulses in levels close to awareness; a strong superego; oral-dependence; obsessive traits; narcissistic traits; masochistic traits; distrust; and ambivalence towards one's own ego. It was also hypothesized that there were significant attitudinal differences between manics and depressives. The depressives would tend to build up depressive fantasies; would feel insecure and inadequate; and would suppress their hostile drives or direct them against themselves. The manics would build up omnipotent fantasies; would be self-confident and self-satisfied; and would express their hostility overtly.

Twenty-five cooperative manics and twenty-five depressives between seventeen and fifty years old, in remission of their symptoms were studied. They had been committed to state hospitals on at least two occasions and had been diagnosed consistently as manic-depressive manic, or manic-depressive depressed respectively. They had not received shock therapy within a six week period prior to testing and had not been psychoanalyzed.

Twenty-five normal controls were selectively chosen equated with the experimental subjects in age, years of schooling, and intelligence. They were deemed to be free of serious emotional disturbance as determined by the Cornell Selectee Index.

The Rorschach, the T.A.T. and the S.S.C.T. were used in studying the personality characteristics mentioned above; the results were considered positive when the data from two or more of the three tests sustained the hypothesis under investigation.

The results of the complete test battery were as follows: None of the personality characteristics hypothesized to identify both the manic and the depressive subjects as compared to the normal controls proved to do so. Nor did the three pairs of dichotomous attitudes hypothesized to differentiate the manics from the depressives do so.

Although not hypothesized as such, differences were revealed on the complete test battery in three instances. The manic group, as compared to the depressives and the controls, tended to suppress or repress hostility. The normal controls built up significantly more omnipotent fantasy as compared to the depressives. The normal controls showed significantly more self-confidence and self-satisfaction than the depressives.

If, however, the results of each of the three tests are considered separately, significant similarities and differences between the manics and depressives are revealed. The depressives build up less omnipotent fantasies than do normals, show less self-confidence, display oral-dependent traits, masochistic traits, depressive fantasies, feel insecure and inadequate and display more object-directed hostile impulses.

The manics reveal the suppression of sadistic drives; object-directed hostile impulses; masochistic traits; depressive fantasies; feelings of insecurity and inadequacy; and less omnipotent fantasies.

Both the manics and the depressives reveal masochistic

traits; object-directed hostile impulses; depressive fantasies; fewer omnipotent fantasies; and proneness to feelings of insecurity and inadequacy.

Distinguishing the manics from the depressives were more self-confidence on the part of the manics; more omnipotent fantasies; more suppression of hostility; and more feelings of ambivalence towards the self. The depressives revealed more depressive fantasies than the manics.

It is suggested for further research that larger samples be tested with respect to those characteristics which gave some indication of differentiating the groups since they apply in most instances to a minority of the subjects tested.

220 pages. $2.85. Mic 58-4467

PSYCHOLOGY, EXPERIMENTAL

THE INFLUENCE OF TRAINING AND FIELD DEPENDENCY ON THE MODIFICATION OF MISPERCEPTION

(Publication No. 24,146)

Harriet June Aronson, Ph.D.
Purdue University, 1957

Major Professor: L. M. Baker

This study was designed to investigate the influence of training on the perception of an illusion. Four instructional conditions were compared with a control condition in order to determine whether different information furnished a perceiver would produce distinguishable changes in perception. The experimental conditions included: fostering insight by suggestion; allowing the perceiver to measure his performance against a criterion; telling the perceiver the amount of his error; and, showing the perceiver the correct solution to the perceptual task.

Change in perception was measured by means of repeated trials on the Müller-Lyer illusion. The first ten trials, composed of five criterion lengths, were used as a measure of pre-instructional perception. On the next five trials, the subjects were each given one of the experimental instructions. The last ten trials, identical in procedure to the first ten, were used to measure change in perception due to instruction.

In order to determine whether ability to utilize the instructions differed in accordance with a specific personality dichotomy, the subjects were divided into two groups, field dependent and field independent. The Rod-and-Frame test, series three, as developed by Witkin, was used to measure field dependency in the sense of Witkin, et al. Change due to experimental instruction was determined for each of the field dependency groups.

One hundred male students registered in Introductory Psychology were subjects. The data were analyzed by means of analysis of variance and the χ^2 test. Individual experimental conditions were compared by means of t-tests.

Three measures were used to determine the influence of the experimental variables: inter-trial variability, number of judgments made with errors opposite in direction to that expected by the illusion, and the linear amount by which the subject's judgment differed from the criterion figure.

It was found that no significant change in inter-trial variability occurred under the experimental conditions.

Under the condition planned to produce insight, none of the measures revealed a significant change in performance. Under the two conditions in which information concerning error was allowed, the proportion of subjects who overcame the influence of the illusion was significantly increased. Also, a tendency toward improving accuracy was found. The condition in which the correct solution was shown brought significant changes in both the proportion who overcame the illusion and accuracy of perception.

The Rod-and-Frame performances of these subjects were more field independent than those reported by Witkin, et al. Reasons for the difference were discussed.

Comparison of field dependency and both initial and post-instructional Müller-Lyer performances showed no significant relationship. However, a significant interaction indicated an indirect relationship between instructional utilization and field dependency.

A trend was found to indicate that field independent individuals tend to increase perceptual accuracy as instructional aid was increased. No consistent relationship was found between field dependent placement on the field continuum and utilization of the experimental instructions.

64 pages. $2.00. Mic 58-4468

CONCEPT LEARNING IN MENTAL DEFECTIVES AS A FUNCTION OF APPROPRIATE AND INAPPROPRIATE "ATTENTION SETS"

(Publication No. 24,460)

Gerard J. Bensberg Jr., Ph.D.
George Peabody College for Teachers, 1957

Major Professor: Gordon N. Cantor

The purpose of this study was to test predictions, based on a mediation hypothesis of transfer, concerning the effects of pretraining, varied both in kind and degree, upon the learning of a subsequent task in male mental defectives. The predictions involved the following considerations: (a) the effects of pretraining upon subsequent learning when the set employed in the pretraining problem is appropriate for the test task; (b) the effects of pretraining upon subsequent learning when the set employed in the pretraining is inappropriate for the test task; (c) the effects of two different amounts of pretraining, under the two conditions mentioned above, on the subsequent learning task; and (d) the effects on test task performance of pretraining designed to institute neither a form nor a color set.

Sixty male mental defectives, having a mean CA of 20.31 years and a mean IQ of 47.01, were randomly assigned to five groups. On the pretraining task, Group I learned to respond to the color aspect of the stimuli. Group II also learned to respond to the color aspect of the stimuli, but received additional trials of training beyond the number of trials given Group I. Group III learned to

respond to the form aspect of the stimuli. Group IV also learned to respond to the form aspect of the stimuli, but received additional trials of training beyond the number of trials given Group III. Group V learned to respond to orally presented stimuli and was not given either a color or form set.

All five groups then learned a task involving the use of the concept of form. The stimuli in this problem involved colors and forms different from those used in the pretraining task. On the basis of a mediation hypothesis, one would expect the groups to carry implicit responses learned in pretraining into a new situation similar to the pretraining arrangement. Therefore, it was predicted that the transfer effect would be positive if these mediating responses were in harmony with the new problem to be solved; if they were inappropriate, the transfer effect would be negative. On the basis of this hypothesis, it was predicted that the groups would distribute themselves in the following order of performance on the subsequent learning task, listed from best to poorest: Group IV, Group III, Group V, Group I, and Group II.

The statistical analysis indicated that there was no significant difference between the performances of Groups III and IV. However, all of the other predictions were confirmed. It was concluded that these results offer rather clear evidence in favor of the theory presented. Certain implications for the utility of the mediation hypothesis in the areas of psychotherapy and education were discussed.

92 pages. $2.00. Mic 58-4469

HABIT ACQUISITION AND EXTINCTION IN THE LABORATORY RAT AS A FUNCTION OF THE NUMBER OF UNREWARDED TRIALS: A COMPARATIVE EXPERIMENT TESTING THE EFFICACY OF THE LEARNING THEORIES OF HULL AND TOLMAN BY LATENT LEARNING

(Publication No. 21,698)

Bruce Lee Cusack, Ph.D.
New York University, 1957

Introduction

Much controversy has surrounded the learning theories of Hull and Tolman in recent years. The question that is basic to this theoretical dispute is: Is reinforcement necessary for learning? Hull answers affirmatively, Tolman negatively.

One of the most promising experiments for resolution of this conflict is latent learning, which can be defined as learning which is ongoing but not manifest. This phenomenon was first shown by Blodgett who compared maze learning for two groups of rats, one fed after each maze run (controls) and the other group unrewarded for several trials, then rewarded (experimentals). On the trial following introduction of reward to the experimentals, learning was equivalent.

As this concept apparently supports Tolman, Hullian theorists have attempted to discredit it. Two "neo-Hullians", Meehl and MacCorquodale, have suggested that the experimental and control groups in the Blodgett latent learning design were not matched for habit strengths or drive states, as they should be within the Hullian postulate that reaction potential equals habit strength times drive state. They suggest that because the controls were fed in the goal box regularly, the maze should have elicited "extroceptive cues" which would predispose the controls to be "psychologically hungrier" than the experimentals. Since the reaction potentials of these two groups were equal, the control group (which has a higher drive state due to the "extroceptive cues") must have a lower habit strength to maintain equal reaction potential. This proposition has not been experimentally substantiated.

The Problem

Do the controls have lower habit strength? If so, they should show a lower resistance to experimental extinction.

Do "extroceptive maze cues" cummulate for initial trials? If so, comparing controls to experimental after different numbers of pre-reward trials should show differential effects.

Procedure

Five groups of rats were run through a Tolman-Honzik maze for twelve successive days, operating under twenty-two hours food and four hours water privation. The controls were reinforced each trial, while the four experimentals were rewarded, respectively, after four, eight, ten and eleven trials (a logarithmic progression).

After twelve acquisition trials, all groups were extinguished for twenty successive runs three different times. According to the Meehl-MacCorquodale hypothesis, the controls should extinguish more rapidly than the experimentals.

Results

Latent learning was tested by comparing the controls and experimentals for greatest single improvement, improvement from the test trial ordinate position, and the performance level at the test trial abscissa point. All three criteria indicated positive results.

Although the latent trials were programmed logarithmically, the effect was linear for time and error scores.

Resistance to extinction did not differ for the controls and experimental one and two, thereby refuting the Meehl-MacCorquodale hypothesis.

Conclusions

The hypothesis of an increased drive from "extroceptive maze cues" for the control group was refuted. Consequently, Tolman's position was favored.

It was felt that acquisition scores are more reliable than extinction scores, for which diametrically opposed results were obtained. The reason for this tentative conclusion was the observation of "emotional" reactions by the animals during extinction which was not present during acquisition.

A differential effect for the number of pre-reward trials was found, indicating that latent learning is enhanced by increasing the number of pre-reward trials.

149 pages. $2.00. Mic 58-4470

THE ROLE OF THE ANTICIPATORY GOAL RESPONSE IN DELAY-OF-REWARD AND IRRELEVANT-INCENTIVE LEARNING

(Publication No. 25,212)

James Albert Dyal, Ph.D.
University of Illinois, 1957

The purpose of this research was threefold: (a) to determine the joint effect on performance of delay of reward (L_G) and time of deprivation (T_D), these experimental variables having been conceived as anticedent conditions related to incentive motivation (K) and drive (D), respectively; (b) to examine whether within-chain delay of reward (L_G) may best be conceived of as a habit variable or as a motivational variable and (c) to utilize recent conceptions of the anticipatory goal response in order to demonstrate irrelevant incentive learning under a strong competing drive.

Seventy-two rats (36 in each of two replications) were given four trials a day in a straight runway with a double goal box. One goal box was black, the other white. The first two trials were free choice (after the first five days all Ss chose the goal box containing a saccharin impregnated wet mash and were thus forced on the last two trials to the goal box containing a .1% saccharin solution). Six groups were run under varying combinations of runway lengths (2, 6 and 10 ft.) and food deprivation (3 and 22 hours). All groups were satiated for water. At the end of 60 trials the groups were bifurcated and shifted to either a 2 ft. or a 10 ft. runway for 40 additional trials. They were then given 20 extinction trials under 3, 12, or 22 hours of hunger or thirst. The results and conclusions were as follows:

1. No significant interaction was obtained between the effects of runway length and time of deprivation. This would normally serve as negative evidence for Hull's multiplicative position, and offer a measure of support for Spence's additive hypothesis. However, the lack of a significant main effect for T_D jeopordizes this interpretation and does not permit us to choose between the additive and the multiplicative hypotheses.

2. The initial effect of shifts in runway length on performance was abrupt, implying a motivational role for L_G-delays as suggested by Spence. A tendency to return temporarily to the former performance level following the abrupt performance shift was interpreted as possible reflecting a temporary frustration effect attendant on shifts in runway length.

3. The Ss which were extinguished under thirst drive showed a significantly greater increase in choices of the saccharin goal box over the five days of extinction than did the hungry animals. The gradual increase in choices of the saccharin goal box, rather than on abrupt shift was predicted since the Ss all preferred the wet mash goal box prior to drive shift. The results were interpreted as positive evidence for irrelevant-incentive learning mediated by the anticipatory goal response characteristic of drinking, and were consistent with the views of Sheffield, Seward and Spence which emphasize the role of the consummatory response in reinforcement.

4. A 'frustration score' was derived from the data and was found to vary with number of training trials, length of delay, drive intensity and drive quality.

The conclusions under 1 and 2 above were tempered by the fact that in the second replication the Ss did not respond differentially to any of the experimental variables.

The results of all phases were related to current conceptions of the anticipatory goal response.

80 pages. $2.00. Mic 58-4471

MASSED AND DISTRIBUTED PRACTICE IN PUZZLE SOLUTION

(Publication No. 24,866)

Edward I. Gavurin, Ph.D.
New York University, 1957

Adviser: Professor Leland W. Crafts

The effect of massed and distributed practice in learning situations in a topic of considerable interest to psychologists. Empirical evidence accumulated to date with respect to conditioning, maze learning, rote verbal learning, etc. supports the conclusion that distributed practice is superior in these situations.

In the area of problem solving, however, the evidence for the superiority of either kind of practice is both meagre and equivocal.

The present experiment was designed to study further the relative effectiveness of massed and distributed practice in puzzle solution when spacing was introduced during the solution process itself. It was pointed out that the superiority of massed practice would favor a Hullian interpretation, while an opposite result would support Guthrie's theory and Estes' extension of it.

Four experimental groups of 21 subjects each were used. Each S was tested on his ability to solve 15 five-letter anagrams. The experimental conditions were as follows:

1. Condition M, which required the solution of the anagrams under conditions of massed practice.
2. Condition S, which required the solution of the anagrams under spaced conditions.
3. Condition MS, which required the solution of each anagram by massed practice, but interpolated intervals between successive items to allow for the dissipation of generalized I_r, which might have been generated by working continuously on homogeneous material.
4. Condition AL, in which S was permitted to choose his own solution method for each anagram and thereby to reveal individual method preferences, if any existed.

The results show that the performance of all four groups was approximately the same. The data from Condition MS indicate that accumulation of generalized I_r was not a significant factor, and the performance of the Ss in Condition AL indicates that the predominant individual method preference involved a combination of massed and spaced practice, rather than the exclusive use of either procedure.

It was observed that these results cannot be explained by either the Hull or the Guthrie-Estes theory alone. Instead, a combination of these viewpoints was employed to account for the data.

43 pages. $2.00. Mic 58-4472

PERCEPTUAL DIMENSIONS FOR THE FRICTION PORTIONS OF CERTAIN SPEECH SOUNDS

(Publication No. 24,867)

Louis J. Gerstman, Ph.D.
New York University, 1957

Adviser: Professor Hans-Lukas Teuber

Psychologists have long been concerned with the question of how perceptual dimensions relate to the patterns of stimulation which support them. The study of speech perception provides a rare opportunity to see how acoustic dimensions relate not only to perceptual dimensions, but also to the dimensions of articulation.

According to phoneticians the fricative, affricate, and stop consonants of American English are all produced with oral friction that is seen in sound spectrograms as noise. A series of experiments has been conducted to determine what features of that noise serve as cues for perceiving the differences among the three classes. A second purpose was to determine whether a single acoustic dimension distinguishes between voiced and voiceless phonemes within each class.

In the first two experiments, tape recordings of the voiceless fricative ʃ (as in "shop") and the voiceless affricate tʃ (as in "chop") were edited in various ways to find out where their distinctive cues were located. It was found that (1) the onset of the friction portion of either syllable supplied a sufficient cue for its identification; (2) when either type of onset was followed by very little additional friction duration, it was heard as its voiced counterpart--the voiced fricative ʒ (as in "azure") and the voiced affricate dʒ (as in "job"); (3) when less than about 30 msec. of friction was present, all stimuli were heard as the voiced stops d or g.

A model was proposed to account for the data in which the friction portions of these sounds were arbitrarily divided into two setments: an onset portion measured as "rise time" and a remaining portion measured as "steady time." Rise time was presumed to distinguish fricatives from affricates while steady time served the voiced-voiceless distinction.

In two additional experiments, the synthetic speech devices at Haskins Laboratories were employed to test the utility and independence of rise time and steady time as dimensions for perception. It was found that both measures generally operated according to the expectations derived from real speech studies, but there was interaction between them: as steady time increased, fricatives were heard at increasingly brief rise times. As in the real speech experiments, stops were heard at brief friction durations and were practically unaffected by variations in rise time and steady time.

Finally, spectrograms from 12 speakers were examined to determine what rise times and steady times normally occur in speech, as well as to see whether other acoustic features might not be operating in this domain. It was found that rise time clearly separates fricatives from affricates, while the voicing distinction is served by steady time, intensity, and the time separation between friction and vowel: voiced frictions are characterized by short steady times, low intensity (relative to the accompanying vowel), and very little separation. The synthetic speech data were now reconsidered in terms of those rise time-steady time combinations that were clearly identified as individual phonemes. A new picture emerged in which there was no longer significant interaction between rise time and steady time.

This result was interpreted to mean that rise time and steady time are valid dimensions for perception, corresponding to the articulatory dimensions of closure and voicing, respectively. Whereas rise time performs a unique perceptual function, steady time is only one of several voicing cues, no one of which is sufficient within the fricative, affricate, and stop classes. It was concluded that the perceptual and articulatory dimensions of speech are intimately linked, but for reasons as yet unknown. Research on the genesis of speech perception should supply an answer here. 181 pages. $2.40. Mic 58-4473

NATURE OF TASTE STIMULATION BY SUGAR

(Publication No. 23,438)

Earl Clifford Hagstrom, Ph.D.
Brown University, 1957

The sense of taste responds differentially to small changes in the structure of the sugar molecule. Similar selectivity in other biological systems has been traced to underlying enzyme systems. In this study, taste sensitivity of the hamster was studied by recording action potentials in the chorda tympani nerve following taste stimulation of the anterior tongue. The influence of certain variables known to effect enzyme systems was examined. In addition, the selective desensitization of sugar sensitivity by gymnemic acid was analyzed.

The results obtained indicate that the selective property of the taste cell is not due to an enzymatic process, but rather to some physical property of the cell surface. It is concluded that the mechanism of sugar stimulation is not fundamentally different from that for salt stimulation. It is probable that different sites of action are involved.
56 pages. $2.00. Mic 58-4474

SCHEDULE OF REINFORCEMENT, AMOUNT OF REINFORCEMENT, AND DURATION OF GOAL CONFINEMENT AS VARIABLES IN CONDITIONING AND EXTINCTION

(Publication No. 23,441)

Stewart Harding Hulse, Jr., Ph.D.
Brown University, 1957

This experiment was designed to investigate the role of schedule of reinforcement, amount of reinforcement, duration of goal box confinement on non-reinforced training trials, and duration of goal box confinement on extinction trials as parameters of resistance to extinction. Two levels of each of these variables were combined in an experimental design which required twelve groups of Ss.

The Ss were 108 male albino rats, 9 rats in a group. The Ss were run, one trial per day, in a four-foot straight alley. Six pre-training trials were given followed by

twenty-four training trials. During pre-training, all Ss received 100% food reinforcement which consisted of either a .08 gm. or a 1.0 gm. (dry weight) wet mash pellet. During training, Ss received 100% or 46% reinforcement, and the partially reinforced Ss were confined in the goal box for either 10 sec. or 60 sec. on non-reinforced trials. All Ss were immediately removed from the goal box after eating on reinforced trials. Amounts of reinforcement were the same as during pre-training. Following training, nineteen extinction trials were given, one trial per day. During extinction, all Ss were confined in the empty goal box for either 10 sec. or 60 sec.

The acquisition results show: a) continuous reinforcement produced faster response speeds than partial reinforcement, but only when large rewards were used; b) large rewards produced faster response speeds than small rewards; c) duration of training goal box confinement did not significantly affect training performance. The extinction data show: a) partial reinforcement produced greater resistance to extinction than continuous reinforcement, but the differences were much greater if large as compared to small rewards were used during training; b) large as compared to small rewards during training produced greater resistance to extinction if a partial regimen were used, but less resistance to extinction if a continuous regimen were used; c) if goal box confinement times were changed from training to extinction for the partial groups, resistance to extinction was less than if no such change occurred; d) neither amount of reinforcement (except over the last nine extinction trials with the alley time measure) nor duration of extinction confinement were reliable factors by themselves in affecting resistance to extinction.

The results were discussed in terms of their implications for theories accounting for the fact that partial reinforcement produces greater resistance to extinction than continuous reinforcement. Empirical implications of the data for future research were emphasized.

108 pages. $2.00. Mic 58-4475

AN INVESTIGATION OF SOME OF THE BASIC LAWS OF GESTALT PSYCHOLOGY: THE EXTENT TO WHICH A VISUAL AUTOCHTHONOUS ORGANIZATION IS AFFECTED BY THE CONDITIONING PROCESS

(Publication No. 24,980)

Richard Hermann Kastner, Ph.D.
New York University, 1957

Chairman: Professor John G. Rockwell

The present study reports an experimental procedure to test the stability of some of the basic Gestalt premises in light of a specific conditioning method. The subjects were presented with a series of designs, on slides, that were grouped in accordance with the laws of similarity, proximity, continuity, and straight continuation. The slide series also had other emphasized design patterns which were so arranged that they tended to disrupt the Gestalt grouping. The subjects were conditioned to respond to the latter group by the finger-withdrawal method induced by a tetanizing shock. The subjects were then presented with a relatively ambiguous slide, so designed that it ranged between the emphasized-shock and the non-shock Gestalt groupings.

The object of the investigation was to determine whether the ambiguous slide was associated with either the shock or non-shock design.

The experimental results indicated that the primary laws were not affected by the conditioning process. All subjects responded to the innate organization in spite of the induced past experience (the conditioning process).

However, it was also found that the subjects did use their experiential background when it came to interpreting the apperceptual material. An inquiry into the nature of their responses suggested that there was a marked capacity to rearrange the apperceptual stimulus in light of the learning situation.

It was further concluded that the essential Gestalt premises were structural organizing agents and must precede any form of behavioristic organization. However, behaviorist mechanisms may function as a secondary agent in organizing the perceptual field.

The data indicated that the constancy phenomenon took precedence over the constancy hypothesis. An integration of Hull's theory in light of the experimental data was offered. Certain neurological implications and general applications of the research were also discussed.

158 pages. $2.10. Mic 58-4476

THE ROLE OF DIFFERENCES OF INTERAURAL INTENSITY AND TIME ON THE LOCALIZATION OF A LOW FREQUENCY TONE

(Publication No. 25,169)

George Moushegian, Ph.D.
The University of Texas, 1957

Supervisor: Dr. L. A. Jefferss

This study presents data on four subjects who attempted to match the position of a 500 cps tone presented via earphones with a wide band noise by adjusting the interaural time-difference of the noise.

The tonal signal was adjusted by the experimenter to have given differences in interaural intensity and time.

A single empirical equation, the constants of which were determined by the method of least squares, expressed the data for each subject adequately. The constants, however, varied from subject to subject.

These equations were then used to derive isolocalization functions for each subject. These functions indicate the various combinations of time and intensity differences that are necessary to effect equivalent localizations.

Time equivalents necessary to offset given intensity differences were determined and it was found that these varied from subject to subject. Two of the subjects' equivalents varied progressively with increasing interaural time delays of the tone, indicating, at least in the case of these two subjects, that the effect of differences of level and of time are not simply additive.

47 pages. $2.00. Mic 58-4477

THE PERSISTENCE OF A RESPONSE IN THE ABSENCE OF APPARENT MOTIVATION

(Publication No. 25,385)

Halbert Benefiel Robinson, Ph.D.
Stanford University, 1957

The persistence of responses in the absence of any apparent motivation furnished the problem for investigation. A relatively complex experimental design was devised in which the hypothesized motivation for a particular response could be removed in order that the effect of such removal on the response in question could be assessed. Experimentation was carried out in four independent and completely automatic shuttle boxes. Subjects were 80 rats, divided into four experimental and three control groups.

Stage I of the experiment constituted straightforward avoidance conditioning procedure. All animals were taught to run to the opposite compartment at the onset of the CS (buzzer, light, opening of door) to avoid just-subtetanizing electric shock. Subjects learned to run when the CS were activated, but only if these CS had been associated with the US.

Stage II involved acquisition of a secondary avoidance response. With a barrier in front of the door of one compartment, the animals learned to press a lever to deactivate the CS, but only if the CS had previously been associated with the US, which was absent in this stage.

Stage III involved for some animals, experimental extinction of the primary response, under massed trials similar to Stage I except that the US never occurred. All animals met the rigorous extinction criterion, but the procedure required a mean of 2500 trials.

Stage IV was a repeat of the procedure of Stage II. It was demonstrated that the extinction of the running response had no significant effect on the strength of the lever-pressing response.

Stage V constituted a repeat of the procedure of Stage III. Contrary to expectation, the strength of the running response had recovered for a number of animals. Control groups demonstrated that this recovery was not a function of the animals' experience in the secondary situation (Stage IV) but rather seemed to be a function of the passage of time alone.

Stage VI involved a repeat of the procedure of Stages II and IV. Again the animals continued to press the lever at a rate far in excess of their free-operant level, although a small but statistically significant decrease had occurred since Stage IV.

Several alternative explanations of the persistence of the lever-pressing response were suggested. The most plausible of these was the hypothesis that extinction of the primary response represented a threshold reduction in which the fear drive and the habit to run were weakened enough so that they were no longer capable of eliciting the running response. Enough fear remained, however, that it could elicit the lever-pressing response in conjunction with the habit to press the lever.

122 pages. $2.00. Mic 58-4478

SOME RELATIONSHIPS OF ANXIETY AND INTROVERSION-EXTRAVERSION TO SERIAL LEARNING

(Publication No. 25,154)

Aron Wolfe Siegman, Ph.D.
Columbia University, 1957

The primary purpose of this study was to test the Taylor-Spence hypothesis that the drive properties of manifest anxiety have a facilitating effect on tasks which elicit a minimum of competing response tendencies (simple learning tasks), and a disruptive effect on tasks which elicit a maximum of competing response tendencies (complex learning tasks). Differential instructions as well as the Taylor MAS were used in order to vary the anxiety variable.

On the basis of Eysenck's causal hypothesis which relates introversion-extraversion to cortical excitation-inhibition it was hypothesized that introverts will be superior to extraverts (as measured by Guilford's R-scale) on a simple learning task, and inferior on a complex learning task.

Finally, the effect of intelligence (as estimated by the Shipley-Hartford Scale) on simple and complex learning under the various motivational conditions of this experiment, was also investigated.

The simple serial learning task consisted of ten nonsense syllables of high association value and low intralist similarity. The complex learning task consisted of ten nonsense syllables of low association value and high intralist similarity. The usual serial learning instructions were given to a control group. Three other groups received the usual serial learning instructions along with other information. One group was given "mildly threatening" information, a second group received "severely threatening" information, and a third group received "success" information. All four groups, consisting of 30 Ss each, were asked to learn the simple task, and only the control and mildly threatened groups learned both the simple and the complex tasks. The four groups obtained comparable means and standard deviations on the Shipley-Hartford Scale.

On the simple task the "mildly threatened" as well as the "encouraged" group obtained significantly higher learning scores than the control group, but the "severely threatened" group obtained significantly lower learning scores. On the complex task, however, the "mildly threatened" group obtained significantly lower learning scores than the control group. The findings suggest (a) that manifest anxiety, if it is not too severe, has a facilitating effect on simple serial learning, (b) that other motivational techniques, such as success information, have an equally beneficial effect, and (c) that even mildly threatening information has a disruptive on complex learning.

As predicted, a significantly positive correlation between Ss' Taylor MAS scores and simple learning scores was obtained in the "mildly threatened" group. The correlations between Ss' Taylor MAS scores and simple learning scores in the control, "severely threatened" and "success" groups were not significant. It was suggested that the failure to obtain a positive correlation in the "success" group supports Spence's hypothesis that the Taylor MAS is a measure of S's potential anxiety level, and not of

S's chronic anxiety level. The predicted negative correlation between Ss' Taylor MAS scores and complex learning scores was obtained only in the control group and only after partialling out the intelligence variable.

The results also confirmed the hypotheses which were derived from Eysenck's physiological explanation of the introversion-extraversion dimension. The predicted negative correlation between Ss' Guilford R-scale scores and performance scores on the complex task, however, was obtained only after partialling out the intelligence variable.

Finally, significant positive correlations between Ss' Mental Age scores and learning scores were obtained in all groups, except in the "mildly threatened" and "success" groups in relation to simple serial learning.

133 pages. $2.00. Mic 58-4479

EYELID CONDITIONING AS A FUNCTION OF INTENSITY OF CONDITIONED AND UNCONDITIONED STIMULI

(Publication No. 25,303)

Evelyn Gladys Walker, Ph.D.
University of Illinois, 1957

The present experiment investigated the effects of conditioned stimulus (CS) intensity on acquisition and extinction of the conditioned eyelid response under different levels of unconditioned stimulus (US).

Eight groups of twenty male subjects each were given eighty acquisition trials under four different stimulus conditions: weak CS-weak US; strong CS-weak US; weak CS-strong US; strong CS-strong US, with two groups under each condition. Each group was then administered thirty extinction trials with the CS-US interval shifted from 500 to 2500 ms. All groups received the same US intensity as during acquisition, with four groups receiving the same CS intensity as in acquisition and the other four groups being shifted from either weak to strong, or strong to weak CS intensity.

The results showed that CS intensity reliably influenced response strength during acquisition. The short latency, "voluntary" responses varied in strength with CS intensity, but the longer latency "CS's" were not affected by CS intensity. There was some evidence that CS intensity had a more pronounced effect on performance under a strong US than under a weak US.

The extinction results showed no evidence of an effect of CS intensity on either learning or performance. However, performance during both acquisition and extinction was a function of US intensity.

In general, the results of this experiment supported the part of Hull's stimulus intensity dynamism principle which postulates an effect of CS intensity on response strength. There was, however, no evidence of an effect of CS intensity on learning as distinct from performance.

30 pages. $2.00. Mic 58-4480

SOME FACTORS INVOLVED IN CONDITIONING THE PUPILLARY RESPONSE TO AN AUDITORY STIMULUS

(Publication No. 24,992)

James Daniel Wood, Ph.D.
New York University, 1957

The purpose of this investigation was to explore some of the factors involved in conditioning the pupillary response to an auditory stimulus. As the discussion of the literature revealed, the controversy as to whether the pupil can or cannot be conditioned by standard classical procedures is very much unsettled. Since conditioning is a basic principle of learning and behavior, it is important to determine whether conditioning can be achieved by using more modern techniques of experimental design and control.

Twenty college student subjects were given fifteen training trials for conditioning pupillary contraction and dilation. An automatic stimulus presentation unit and infrared cinematography were used to attain the maximum precision and control of the experimental variables. The photographic record was transcribed from 12,000 frames, into time series plots which clearly reveal each change in pupillary diameter.

The results of the study show that classical pupillary conditioning did not occur; there was no evidence, therefore, to support the belief that pupillary conditioning is a typical example of the classical S-R paradigm. The experimental data also indicate that there is no statistically significant relationship between speed of response and success or failure to condition. Differential conditioning did not occur. Three of the twenty subjects, however, did show minimal evidences of contraction conditioning.

Based upon a review of several current learning theories, predictions of pupillary conditioning results were made and compared with the hypotheses of this study and with the experimental results obtained. The theory which predicted the experimental results of this study most satisfactorily was Spence's two-factor formulation.

Spence's suggested theory states that "...if one were to adopt a theory that reinforcement (e.g. need reduction) plays a decisive role in the acquisition of habit strength of classical conditioned responses but not in the case of instrumental conditioned responses, one would have a two-factor theory that is exactly the opposite of the well known two-factor theory espoused by Schlosberg, Mowrer and others."[1] It is this tentative statement which permits predictions that are compatible with the experimental results of the present study.

Implications of the study for applied research were considered in the course of an examination of studies concerned with classroom learning and clinical theory and techniques. Analyses of this material, and its relationships to physiological structure and events, serve to emphasize the need for long range studies of the sympathetic-parasympathetic balance and concomitant changes in emotional behavior. 101 pages. $2.00. Mic 58-4481

1. K. W. Spence, quoted from manuscript. E. R. Hilgard, Theories of Learning, p. 416.

THE BOARD OF CHRISTIAN EDUCATION IN A CONGREGATION OF THE EVANGELICAL LUTHERAN CHURCH

(Publication No. 25,489)

Wallace Jerome Asper, Ed.D.
New York University, 1957

The purpose of this investigation is to describe and to evaluate various plans of organization for parish Christian education and to make recommendations for establishing a more effective plan for a board of Christian education in a congregation of the Evangelical Lutheran Church. The study is directed toward Trinity Lutheran Church in Brooklyn, New York, where the investigator has served as a pastor for about seven years. The congregation, organized in 1890, has had a board of Christian education for twenty years and currently has a Sunday church school enrollment of nearly eight hundred pupils.

Four plans of organization for parish education most commonly found within Protestantism were described. Objectives and functions of organizational plans were also described with special attention given to those most commonly found in or most urgently proposed for parish education. Data were gathered from standard texts and manuals in religious education, from publications of the Division of Christian Education of the National Council of the Churches of Christ in the U. S. A., from denominational offices of parish education, and from selected congregations of the Evangelical Lutheran Church.

There being no established standard in the Evangelical Lutheran Church for evaluating organization and administration of parish education, a standard was constructed and submitted to a committee for validation. This standard was then applied to that which was found to be most characteristic of each plan of organization. The standard included tests of definitive authority, comprehensiveness, correlativity, selection and orientation, rotation and continuity, democratic principles, leadership relationships, pupil relationships, accountability, tools for the task, financial policies, meeting practices, and evaluations. It was found that the plan which provides for an authorized board of Christian education is capable of meeting all the requirements of the standard, is the plan most frequently recommended by denominational offices of parish education, and is the plan which can best serve the needs of Trinity Lutheran Church.

Recommendations were made regarding objectives, plan of organization, and functions for the board of Christian education at Trinity Lutheran Church. These were submitted to a jury of experts in the Evangelical Lutheran Church for appraisal; the appraisals were incorporated in the document.

A study committee of the congregation co-operated with the investigator in establishing a plan for applying the recommendations to the congregation.

The study reveals that, while Christian education is the responsibility of the entire congregation, the educational work of the church is a major and special task requiring the skilled and dedicated attention of an authorized board. The study proposes objectives, a plan of organization, and functions for reorganizing and improving the board of Christian education at Trinity Lutheran Church in Brooklyn, New York. 262 pages. $3.40. Mic 58-4482

A CRITICAL COMPARISON OF THE TEACHINGS OF NEW TESTAMENT CHRISTIANITY AND EARLY STOICISM

(Publication No. 24,979)

Robert Lee Johnson, Ph.D.
New York University, 1957

Introduction: The primary objective in this investigation was to discover and bring into focus the similarities and unique elements in the writings of the Stoics and the New Testament. Earlier studies by both German and English writers dealt chiefly with individual Stoic authors and the comparison of their writings to certain New Testament concepts. This study embraces the literature of the Stoics both in the Greek and Roman periods, especially as reflected in the writings of Zeno, Cleanthes, Chrysippus, Seneca, Epictetus, and Marcus Aurelius.

Stoicism offered certain solutions to many problems about which education, philosophy, and religion are always concerned. The Stoics taught procedures of learning, self-discipline, and emotional control with a view to shaping the attitudes and conduct of the individual. The New Testament took shape when Stoicism was almost at the height of its popularity, and men have often speculated on the possibility of interrelationships between the New Testament and Stoic writings.

Specific Categories Treated: The scope of the investigation is broad and is designed to include practically all subjects where some basis of comparison might be established between the Stoic literature and the New Testament. The principal categories in the study are Theology, Worship, Cosmology, Anthropology, Ethics, Sin, and Perfection. Sub-headings that also receive special emphasis are Will of God, Fate, Fortune, and God's Relation to Man.

Sources and Materials: The Revised Standard Version of the New Testament is used almost exclusively in the study but the original Greek text is occasionally cited for purposes of clarification. Von Arnim's Stoicorum veterum fragmenta represents a chief source for Stoic literature, but the English translations of the Loeb Classical Library are used extensively in compiling the data on Stoicism. Among the volumes in the Loeb Classical Library most frequently used are Marcus Aurelius, Cicero, Epictetus, Diogenes Laertius, Philo, Seneca, and Sextus Empiricus.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The standard works of Zeller, Arnold, and Hicks, are cited in non-critical areas of the study.

Methods and Procedures: The New Testament and the Stoic literature received a thorough and objective examination and all materials related to the categories of the study were classified. These materials constitute the data and are presented verbatim in the study. The data are then summarized in parallel columns. Conclusions and criticisms are drawn from the data presented.

Summary of Findings: Conclusions drawn by earlier writers who have studied individual Stoic authors find new justification in this dissertation. No agreement is found between the Stoic and New Testament concepts of Theology and Cosmology. Though the objects of worship are different in the two systems, there is accord in the emphasis that both place on the spirit and attitudes of worship. There are both similarities and differences in the respective views of man. The New Testament and Stoic views of the will of God are unlike. It is in the realm of ethics that Stoicism and the New Testament have the greatest affinity. The New Testament and Stoicism hold certain ideas in common but the systems are still radically different. What agreement there is between the two is found chiefly in single doctrines and not in fundamental principles.

That Stoicism has had an influence upon modern theories of education is avowed by at least one authority. Whether Stoicism is re-emerging in modern "Christian" thought is a question posed at the conclusion of the study.

255 pages. $3.30. Mic 58-4483

SOCIAL SCIENCE GENERALIZATIONS FOR USE IN THE SOCIAL STUDIES CURRICULUM: EXPRESSING RELIGIOUS IMPULSES

(Publication No. 25,354)

John Robert Lee, Ed.D.
Stanford University, 1957

The Problem

This dissertation represents one of a series of studies concerned with reporting generalizations identified through an analysis of literature selected from (1) the social science disciplines of anthropology, economics, geography, political science, social psychology, and sociology; and (2) the field of religion. The scope of this particular study involved identifying and reporting generalizations concerned with the expression of religious impulses as one of man's basic human activities. The generalizations reported in this study deal (1) with the corporate efforts of men to express themselves religiously, rather than with individual modes of religious expression; (2) with the empirical character of religious expression, rather than with the normative question of what religious expression ought to be; and (3) with this question: "What have people done together when they have conceived themselves to be acting religiously?"

The Procedures

The major procedures involved in carrying out this study were (1) selecting a bibliography (thirty-six books from the social sciences and nine books from the field of religion); (2) defining the term generalization and establishing the criteria for selection of data; (3) extracting the generalizations; and (4) synthesizing and classifying the generalizations into categories suitable for reporting them as data.

For the purposes of this study, a generalization was defined as a universally applicable statement at the highest level of abstraction relevant to all time or stated times about man, past and/or present, engaging in the basic human activity of expressing religious impulses. The criteria for selection provided that (1) opinions, literal facts, concepts, and definitions are not generalizations; (2) the stated generalization is not limited by reference to specific geographic or cultural boundaries; (3) the generalization must deal with man in a societal orientation, not as an isolated individual; and (4) the stated generalization, or the context in which it appears, shows that the author believes that there are no known exceptions.

The Data

The data were classified within the following major categories: (1) Intellectual Religious Expression; (2) Cultic Religious Expression; (3) Organizational Religious Expression; (4) Dimensions of Religious Expression; and (5) Institutional Interrelationships. A section of Chapter III, "Presentation of the Data," is reproduced here:

3. Organizational Religious Expression

". . . at all levels and in all its forms religion seeks to fit into an existent group life of some sort, or to create its own distinctive groups."

39-121. 10-663; 10-685; 10-693; 22-52; 39-33; 39-48; 39-55; 39-76

[Religious] "institutions are forced to undergo [change] when the ecological and cultural conditions of their environment have been radically altered."

11-411. 7-245

". . . religious organization is no exception to the generalization that institutions tend to disintegrate and new social patterns to originate during periods of unrest."

11-404

The 267 generalizations reported in this study should be useful to different lay and professional groups interested in social studies programs. These generalizations represent a readily available body of data dealing with religious expression, drawn from scholarly disciplines and categorized in cross-disciplinary and cross-cultural terms. These reported data should provide future researchers with the material needed for testing hypotheses about religious expression as a topic of study in the social studies. 184 pages. $2.40. Mic 58-4484

AN EVALUATION OF FIFTEEN METHODIST CHILDREN'S AGENCIES: A STUDY OF THE NEEDS OF DEPENDENT CHILDREN AND THE STATUS OF INSTITUTIONS PROVIDING FOR THEIR CARE

(Publication No. 24,187)

Edward C. Peterson, Ed.D.
New York University, 1957

Chairman: Associate Professor Lee A. Belford

Problem and Limits: The author defined the problem of the study as follows: To collect and analyze data on the fifteen Children's Agencies sponsored by the Woman's Division of Christian Service of the Board of Missions of The Methodist Church operating under the supervision of the executive secretary of Social Welfare and Medical Work for purpose of description, comparison, evaluation and recommendation. In order to evaluate this group of institutions offering twenty-four hour a day care for dependent children answers were needed for the questions: What are the special needs of the dependent child in the United States? What social welfare services are offered the dependent child in the United States? How has the Methodist Church sought to serve dependent children? How do these fifteen agencies actually serve the special needs of dependent children? What social welfare services do they offer? How do these agencies relate to the ministry of The Methodist Church? What is the status of these agencies when evaluated by the official standards and goals for Methodist Children's Agencies?

Procedure: The author developed a bibliography and read widely in it searching for answers to his questions from published authorities. His questions concerning the specific agencies were answered by the study of reports and documents on file in the national office which administers them, by each agency's completion of extensive questionnaires based on the Child Welfare League of America institution study schedules, by personal visits to a majority of the institutions and by interviews with persons who had first hand knowledge of each agency.

Findings and Conclusions: The dependent child's special problems are born of the emotional trauma he experiences because of his separation from his parents. This turmoil often results in personality damage. For some such children institutional group care can be therapeutic; for others group care is damaging. These agencies are weak in careful casework to insure that children accepted for care can profit most by it. These agencies excel in providing for children's physical needs in a group setting. The religious service motivation of many employees is an important asset. However, lack of trained staff qualified to deal with the deeper life needs of these troubled youth constitutes a serious failure. Short staff tenure means children often out-stay staff and suffer additional separation from loved adults. Most children in agencies are from broken homes and so are exposed to repeated emotional upset. Lack of adequate mental health service and treatment limits the effectiveness of these agencies as a group. Progress is evidenced, but much remains to be done.

321 pages. $4.15. Mic 58-4485

CLOTHING LEADERSHIP AMONG BOYS

(Publication No. 24,062)

Albert Seymour Glickman, Ph.D.
The Ohio State University, 1952

The investigation had as its general purpose the exploration of the psychological, social, and economic variables characterizing adolescent boys who are identified by their peers as "clothing leaders," to provide information applicable to refinement of marketing methods and to increase understanding of the role of clothing in the total picture of the attitudes and interests of youth. In specific terms, the main objective was to determine what variables are associated with clothing leadership, and to develop a procedure for predicting it.

A variety of questionnaire approaches were used to obtain information from boys in the fifth through the tenth grades of public schools in two cities, Chappaqua, New York, and Atlanta, Georgia. Most of the children came from homes of above average income levels.

One hundred ninety-nine boys were tested in Chappaqua in June, 1950. Three hundred twelve boys were tested in Atlanta in December, 1950, and January, 1951. These included some fourth-graders. After the fourth-grade pupils were removed from the sample and all unidentifiable respondents were eliminated, the respective numbers were 190 and 285.

Preliminary analysis of the Chappaqua data was performed in order to construct a "socioeconomic index," a "clothing leadership index" aimed at determining whether leaders preferred different styles from those that non-leaders liked, and three "clothing attitude scales" derived from iterative analysis of a twenty-nine item "disguised-structured" check list of attitudes toward clothing. These measures were used for the Atlanta population also.

Separate preliminary analyses were conducted to obtain a "clothing conformity index" for each grade of each school, to measure the degree to which a boy's choice of clothing agreed with the choices of his classmates.

A total of thirty-nine variables were used. In addition to the aforementioned, they included sixteen sociometric items dealing with various aspects of adolescent activities, and other items giving information concerning age, grade at entry to present school, height, weight, television ownership, athletic and club activity, movie attendance, intelligence quotient, number of older and younger brothers and sisters, number of regular residents in the home,

source of ideas about what to wear, and interest in girls and clothing. Distributions of scores for these variables were obtained.

These variables were first subjected to factor analysis. Then factor scores obtained were treated by multiple regression analysis, based upon 133 Chappaqua cases and 193 Atlanta cases for whom complete data were available. The cases were shown to be representative of the original samples. Analyses were performed separately for the two sample groups. This permitted cross-comparisons and tests of generalization, using each sample as a check upon the results of the other.

Factor patterns of the two samples of data were found to resemble each other closely.

The dichotomous criterion of "clothing leadership" used was based upon responses to the sociometric item: "There are some boys who dress just the way most boys would like to dress. Other boys would like to wear the same kind of socks, shoes, sweaters, suits, pants, and other things that boys think are swell and like to wear." Boys who received more nominations for being "most like" this description than for being "least like" the model were called "clothing leaders." Others were designated "non-leaders."

The outcomes of the final step of multiple correlation and validity-generalization tests were as follows.

Three factors met the test of validity-generalization as predictors of "clothing leadership." These were, in order of their average contribution to the variance of the criterion, "group leadership," "status appeal of clothing," and, with a negative weight, "older brother influence."

When eight items from the "group leadership" factor and one item from each of the other two factors which had demonstrated predictive utility in both Atlanta and Chappaqua calculations were made into a simple ten-unit "clothing leadership predictor scale," a correlation of .38 was obtained with the criterion. This was the best consistent predictor. When used with a moderately stringent selection ratio, this scale showed promise of practical utility. The conclusion was drawn that "clothing leadership" could be predicted satisfactorily from the independent variables named.

The eight "group leadership" items were sociometric descriptions of boys who are unselfish, good in games, good sports, not snobbish, activity leaders, loyal club members, and popular as committee members and as friends. A ninth point was scored on the "status appeal of clothing" item by one who inclined to the beliefs that "boys want to be allowed to pick more of their own clothes," "boys dress to be like other boys," and "boys who do not dress well are looked down upon by other boys." The tenth point was obtained by those who did not have older brothers.

On the basis of certain theoretical considerations the opinion was advanced that one other factor, namely "social acceptability," stands a good chance of developing into a useful predictor. Although it proved to be the chief predictor of the criterion for the Atlanta sample, it failed to do so in the Chappaqua population. This result was ascribed to the inhibiting effect upon the correlation of the more restricted socioeconomic variability of the Chappaqua group.

It was suggested that a similarly restricted range of talent might explain why the "verbal intelligence" factor which served as a predictor in Atlanta failed to do so in Chappaqua, but the statistical facts were equivocal in this regard.

On the basis of the available data, within the limits of sampling and the techniques of analysis used, the following interpretations were derived.

It seems that clothing leadership is a rather specific kind of leadership, fairly distinct from the various other aspects of group leadership, although somewhat dependent upon it. The persons most likely to be looked upon as clothing leaders tend to be those who are leaders in cooperative group activities, who see in clothing symbols of status and acceptability, and who have no older brothers.

It appears that a minimum degree of conformity is a necessary, but not sufficient, condition for clothing leadership, although there is enough leeway for deviation within the limits of acceptable dress established by the group so that clothing leaders can be recognized by others as possessing certain special qualities.

Secondary findings reveal supplementary implications, particularly with regard to various attitudes that boys have concerning clothing.

It is noted that these attitudes toward clothing are fairly well structured, three factors having been isolated in the check list: "belongingness—security value of clothing," "direct interest in clothing—fastidiousness," and "status appeal of clothing." Of these the last is the most salient and is the only one that helps to predict the criterion.

Examination of the intensity of various attitudes towad clothing contradicts the notion that ten to fifteen-year-old boys are indifferent to dress and appearance. The contrary is strongly indicated in terms of verbal reaction and in the agreement the boys demonstrate in the selection of clothing items when alternative choices are shown to them. They appear to know what they want-- and what they do not want-- and they want more freedom to choose what they want.

They appear to want to dress attractively in a "relaxed" fashion. They accept conformity to the group norms but resist emphatically the attempts of "outsiders"--mothers, teachers, salesmen, etc.-- to impose an apparel code; to make them "dress up." If one seeks to change the clothing habits of boys, the evidence of the present research supports the view that such changes must be effected through changing the fundamental frame of reference of the group. The most effective way of motivating the boy customer seems to be through bringing about identification of the desired choice with the boy's group and the group's leaders with whom he identifies himself.

A number of other illustrations are given as to possible means of translating the findings into practice in the family and in the boys' wear business. Among these are the suggestions that an approach that emphasizes what "everyone is wearing" is likely to have more appeal to an adolescent boy than one which emphasizes uniqueness, and that it might prove worth while to encourage boys to buy more of their own clothes by providing special facilities and services for those who shop alone or with other boys.

The critical need for additional careful research is indicated. Among those projects especially needed to clarify some of the findings of this particular research, the following are suggested:

(1) Testing the validity-generalization of the "clothing leadership predictor scale" on a new population sample

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or several samples to establish the extent of its general usefulness

(2) Examination of the potential validity of the "social acceptability" factor as a predictor of clothing leadership

(3) Determination of the stability of the iterative analysis which produced the three clothing attitude scales, by repeating the analysis on other samples

(4) Further validation of the technique of pre-testing consumer preferences through the use of the lantern slide for presenting alternative choices, by determining the correlation between such choices and an operational criterion such as retail sales of the item

(5) Research in which the dress of "group leaders" and "clothing leaders" is experimentally manipulated, followed by measurement of the respective changes that take place in the position of those leaders in the peer group and the behavior of the group in dress and in various coöperative group activities.

Such investigations of the clothing habits of boys are needed to make possible a unified and sound system of theory allied with more satisfactory practice.

316 pages. $4.05. Mic 58-4486

Abstract published by special arrangement with The Ohio State University.

MOTIVATIONAL AND SOCIAL FACTORS IN CHILDREN'S PERCEPTIONS OF HEIGHT

(Publication No. 25,383)

Juliet Martha Popper, Ph.D.
Stanford University, 1957

This study was an investigation of children's perceptions of the heights of themselves and certain adults well known to them. It was primarily exploratory in nature, but in addition tested several hypotheses suggested by previous theorizing and research in related areas. It was hypothesized that individuals of greater perceived importance would be overestimated in height. Assuming that distortions in the perceived height of the self are related to feelings of adequacy in controlling the environment, it was also hypothesized that children of low intelligence would underestimate themselves more than children of high intelligence, and that failure experiences would result in a decrease in estimated self height.

The subjects were 220 elementary school children in grades five through eight. Each subject estimated his height and that of his mother, father, school principal, teacher, teacher of the previous year, and the experimenter in relation to two sticks of different heights. The sticks were set up vertically, one at a time, in front of the classroom. For each individual whose height was being estimated, the children made a mark on a line, a portion of which represented the height of the stick, to indicate where the top of that person's head would be if he were standing next to the stick. From these marks, an estimate of the perceived height of that individual could be obtained. Using a similar procedure, each child compared himself in height directly to each of the adults whose heights he had estimated. These judgments of height were made twice, with a two week interval between sessions.

It was found that the children significantly underestimated their own heights in relation to both sticks and to all adults. It was predicted that children would underestimate their teachers of the previous year more than their current teachers because of a difference in importance; this prediction was confirmed.

Differences due to grade level were minimal, but important sex differences emerged. Girls underestimated themselves more than boys in relation to all adults, and, as compared with boys, overestimated men in relation to women. For boys, there was a significant relationship between intelligence and estimated height of self in relation to adults, as predicted, but no such relationship appeared for girls.

Immediately prior to the second height test, failure experiences were induced in some children by giving them difficult anagram tests, while other children received easy tests and some received no tests at all. Various measures of the degree of failure experience were employed, and using each of them the hypothesized relation between failure experiences and changes in estimated self height appeared for the boys, either approaching or reaching significance. There was no evidence for such a relationship in girls.

In conclusion, the hypothesized relationship between the perceived height of others and their perceived importance was supported by the data. The hypotheses relating perceived self height to other characteristics of the self were tentatively supported for the boys, but were not supported for the girls. An attempt to account for the sex differences suggested by the results considered their possible relation to the different values placed on being tall, and the different types of valued and approved behaviors within the two sex groups.

64 pages. $2.00. Mic 58-4487

SOCIOLOGY, GENERAL

AN ANALYSIS AND MEASUREMENT OF VALUE ORIENTATIONS AS RELATED TO CONVENTIONAL AND DELINQUENT BEHAVIOR

(Publication No. 25,199)

Jay Grant Butler, Ph.D.
University of Illinois, 1957

Delinquents are conceived as thinking and feeling differently than non-delinquents in their evaluations of the behavioral expectations of delinquent and conventional culture. These evaluational processes have been differentiated into four valuational frames of reference -- instrumental, ethical, aesthetic, and hedonistic. These are conceived as having a bimodal character: The instrumental and ethical represent the "objective orientation;" the aesthetic and hedonistic represent the "subjective orientation."

On the basis of the foregoing conceptualization of valuational processes it has been possible to restate value reaction theories of Cohen and others in the following terms: All youth are exposed to efforts by others to teach them favorable "objective" valuations of conventional expectations and unfavorable "objective" valuations of delinquent expectations. Some youth, because of handicaps of "lower class" rearing or for other reasons, experience unfavorable "subjective" reactions to delinquent culture, which conflict with their "objective" valuations. The persistence of such conflict leads to neuroses. The delinquent gang, however, permits development of unfavorable "objective" orientations toward conventional culture and favorable "objective" orientations toward delinquent culture, eliminating conflict of values in the confirmed delinquent or criminal group.

Previous formulations have not analyzed the intervening mental or "meaning system" variables in delinquency in as systematic fashion as this, and usually have merely illustrated, rather than tested, their theories. The present research has involved the representation of delinquent and conventional cultures by lists of specified behavioral expectations, and has had subjects evaluate these behavioral expectations by scales of the semantic differential type representing each of the four valuational frames of reference. The eight scales used in testing hypotheses were selected from twenty-four preliminary scales on the basis of reliability and index validity of responses received from a preliminary sample. Also, subjects were classified with respect to delinquency or non-delinquency by frequency responses on reported behavior check lists.

The first sample consisted of fourteen ninth grade boys. The results of this sample were further substantiated by a second sample of thirty-nine boys.

Our findings strongly confirm our hypothesis that delinquents can be distinguished from non-delinquents by their evaluations of the conventional and delinquent cultures by each of the four frames of reference. Our findings also impressively demonstrate the bimodal nature of these frames of reference. Delinquents can be differentiated from non-delinquents more by their "subjective" orientations than by their "objective" orientations. An effort to distinguish delinquents from non-delinquents by the degree of "priority" which they assign to "subjective" valuations did not yield conclusive results, although differentiations found were in the expected direction. The application of our measures to more contrasting delinquent and non-delinquent youth and some revision of the procedures were suggested for future research.

270 pages. $3.50. Mic 58-4488

AN INVESTIGATION OF SELF-ORGANIZED GROUPS OF PARENTS AND RELATIVES IN FIELDS OF PHYSICAL AND MENTAL HANDICAP

(Publication No. 25,146)

Alfred Hyman Katz, D.S.W.
Columbia University, 1957

Because of the rapid rise to prominence of the many self-organized groups, their relative newness, and somewhat novel character, they pose urgent practical and theoretical questions for professional workers and agencies in the social welfare field, both governmental and voluntary.

The purpose of the present study was to conduct an exploratory investigation of such groups to study the following factors:

(1) origin and rapid growth during the past decade;

(2) the motivations and objectives of the founders, leaders and members;

(3) their relationships with established social and health agencies and professionals;

(4) their programs and future course of development.

Method of Study: From a universe of 22 organizations found in the New York area, a purposive sample of four organizations was chosen for intensive case study. One hundred interviews were conducted with leaders, other lay participants and professional workers in these groups, and with outside professional workers in service, coordinating and governmental agencies, both local and national, which had had experience with such groups. Extensive correspondence was held with councils of social agencies to obtain similar information on local groups. Minutes, publications, journals and press releases issued by the four organizations were extensively reviewed.

Findings and Conclusions: It was found that the self-organized groups originated in a common pattern--being formed by parents conscious of the need to effect better services for their children than could be obtained through existing sources.

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The groups form a vehicle for the expression of an unusually intensive form of voluntary membership participation, particularly in their early phase, which enabled them to make rapid progress in the development of program and public support.

The degree of parental participation declined with the growth of staff members, and the tendencies toward "professionalization" and bureaucratization. But the most successful of the groups retain a significant component of parent participation, a factor which distinguishes them sharply from other voluntary agencies in the health and welfare field, and that gives them greater resemblance to other forms of membership organizations.

While other agencies and professional workers have found some difficulties of relationship and co-ordination in working with the self-organized groups, many positive experiences have been found, which indicate that the groups can accept the assistance of outside professionals when tactfully offered. Such assistance must take into account the membership character of the groups, the emotional involvement of parents, their impatience with certain professional standards and procedures. Once this is recognized, the groups can be helped to make an important community contribution, as they represent the application of a creative form of democratic self-help.

338 pages. $4.35. Mic 58-4489

SOCIAL DIFFERENTIATION: A DEMONSTRATION IN THEORY CONSTRUCTION

(Publication No. 24,076)

Richard Thacker Morris, Ph.D.
The Ohio State University, 1952

The relevance of the process of social differentiation to the understanding and prediction of human behavior has been demonstrated by many social scientists. The basic question as to how individuals and collectivities order their social universe is one that requires both theoretical and research effort for its resolution. The present study attempts to codify research and theory in this area, construct theory, and make suggestions for future theoretical contributions and empirical research.

There are three chief tasks set before the codifier. First, he must survey and integrate existing, often disparate and partial, theoretical attempts in his chosen area. Second, he must survey and integrate existing empirical findings and methodology, in whatever areas he may find them, so long as they throw light upon existing theory, support it, and add to it. Third, and perhaps the most difficult, he must integrate the codified body of theory with the codified body of research results, showing the gaps and lack of continuity in both, and making suggestions for systematic future work at both levels so that each may contribute to the other in a cumulative, orderly fashion.

The method for codification will be the paradigm. Indeed the entire study has been arranged in an effort to show, step by step, how the paradigm came into being and what can be done with the finished product in terms of its taxonomic function and the formation of hypotheses and proposals for research. However, the primary function and purpose of the paradigm, and of the dissertation, is not a taxonomic one, but rather an effort toward theory construction and problem solution.

The construction of a paradigm is contingent upon the extrapolation of elements and processes that are common to the major portion of researches and theory in the area of social differentiation. Two characteristics appear to the author to fulfill this condition: a psychological process and a resultant perceived structure. Careful examination of the nature of both processes and structure yields the following framework of analytically distinct elements:

I. The individual or plurality of individuals who perceive other individuals, singly or in plurality, as identified units (the ascriber)

II. The characteristics of the individuals who perceive others (characteristics of the ascriber)

III. The individual or plurality of individuals who are perceived (the ascribee).

IV. The characteristics of the perceived individuals which are selected and utilized for the assignment of difference or similarity, or which are used as a basis for evaluation (the criteria).

V. The act or process of assigning differences of similarity to identified units, the evaluation of units, the placing of units in order of evaluation, the placing of units into categories, the assigning of difference or similarity to categories, the placing of categories in order of evaluation (processes of social differentiation).

VI. The resultant position of units in order of differentiation or evaluation, or in a category, the categories themselves, the position of categories in an order of differentiation or evaluation (structural components).

VII. The discovered characteristics of the units or categories after they have been placed (correlates of positions and structures).

VIII. Changes in any of the elements listed above (mobility and structural change).

IX. Classification schemes of total structures based upon the elements listed above (types of structure).

Thus, as can be seen, the elements of analysis of studies of social differentiation (a general term including studies of class, status, and stratification) include the individuals engaged in the process of differentiation, the process itself, and the resultant perceived units, categories and arrangements or system of units and categories. This analytic scheme provides the initial form of the paradigm. Any particular study probably will not fill in all the cells or include all the elements listed above. It is precisely for this reason that the list of elements as an initial framework is useful for the systematic comparison of studies, including their concepts, terms, methodologies, and results. Such a scheme immediately demonstrates the lack of common elements dealt with, frequently leading to critical analysis and new hypotheses.

The process of refinement of the elements of analysis leads to the development of a comprehensive glossary of concepts presented below:

1. The Ascriber: (1) actor-ascriber, (2) self-ascriber, (3) informant-ascriber, (4) reporter-ascriber, (5) observer-ascriber, (6) objective-ascriber, (7) primary

ascriber, (8) secondary ascriber, (9) reputational ascriber, (10) ascriber bloc, and (11) relevant ascriber.

II. Characteristics of the Ascriber: (1) position of the ascriber in the structure, (2) relation of the ascriber to the ascribee, (3) personal characteristics of the ascriber: psychological, ideological, physical, social, and behavioral.

III. The Ascribee.

IV. The Criteria: (1) differentiating criteria, (2) evaluative criteria, (3) initial criteria, (4) subsequent criteria, (5) first-level criteria, (6) second-level criteria, (7) third-level criteria, (8) observed criteria, (9) reputed criteria, (10) congenital criteria, (11) emergent criteria, (12) sustained criteria, (13) achieved criteria, (14) controlling criteria, (15) controlled criteria, (16) criterion cluster, (17) key criterion, (18) criterion halo effect, (19) official criteria, (20) conventional criteria, and (21) unstandardized criteria.

V. Processes of Social Differentiation: (1) differentiation, (2) specification, (3) articulation, (4) rating, (5) ranking, (6) categorization, (7) segmentation, and (8) stratification.

VI. Structural Components: (1) structure, (2) position, (3) identity, (4) situs, (5) rating, (6) rank, (7) category, (8) undifferentiated category, (9) articulated category, (10) ranked category, (11) segment, and (12) stratum.

VII. Correlates of Positions and Structures: (1) correlate, (2) locational correlate, (3) category correlate, (4) structural correlate, (5) individual correlate, (6) role, (7) collectivity correlate, (8) social class, and (9) institutional correlate.

VIII. Mobility and Structural Change: (1) structural change, (2) mobility, (3) attributive mobility, (4) procedural mobility, (5) originative mobility, (6) mobility discrepancy, (7) vertical mobility, (8) horizontal mobility, (9) diagonal mobility, (10) intramobility, (11) intermobility, (12) mobility distance, (13) mobility rate, (14) mobility volume, (15) mobility chance, and (16) mobility channel.

IX. Types of Structure: (1) classified by the relative number of positions in the structure, (2) classified by the relative number of ascribees in the positions of a structure, (3) classified by the relative rate and volume of mobility within the structure.

The utility of the resultant paradigm for critical evaluation and isolation of the variables involved is demonstrated when each of the following studies is analyzed:

1. Max Weber[1,2]

Weber is essentially an objective-ascriber, and, although he is aware of the placements made by actor- and self-ascribers, he does not focus upon them or their characteristics; he uses three main clusters of criteria simultaneously and arrives at three unevenly analyzed coexistent structures: class structure based upon economic chances, status structure based upon style of life, and party structure based upon political power. He limits his processes of differentiation to stratification, or the evaluative arrangement of categories, and thus limits his structures, as well as the types of mobility within them, to vertical arrangements of categories, omitting the possibility of differentiation without evaluation and the possibility of differentiation within categories. His discussion of correlates includes cause and effect relationships between structural components and other variables, as well as the consideration of cause and effects of mobility and structural change.

2. Talcott Parsons[3]

Parsons is an observer-ascriber concerned with the way actor- and self-ascribers place one another. He attempts to explain the reasons for and functions of differentiation for the ascribers and centers most of his analysis upon the systematic classification of criteria and their development. Although he recognizes the use of a number of differentiation processes, he limits his analysis of structural components to a few crude concepts. As a result of this lack of systematic structural elements, the analysis of mobility and types of structure is limited. Significant contributions are with respect to the correlates of mobility.

3. Richard Centers[4]

Although Centers purports to be a reporter-ascriber and to be engaged in the process of discovering how actor-ascribers place one another and themselves in a society, he is, in reality, behaving as an objective-ascriber on several counts. In the first place, he uses his own criteria, makes and stratifies his own categories when he deals with occupational and other strata and places ascribees in them. Second, he supplies the categories for self-ascribers when he asks them to place themselves in classes. Third, he supplies a set of criteria for the actor- and informant-ascribers, either directly or by precept, and also a set of predetermined categories already ranked, when he asks respondents to place others in the various classes, whether their own or other classes. Owing to the imposed and limited nature of the differentiation processes and categories, the actor-ascribers and Centers himself are restricted to a perception and description of a single vertical structure made up of a small number of undifferentiated categories; i.e., units are undifferentiated within categories, and the possibilities of segmentation, articulation, and ranking are precluded. Any studies of mobility within such a structure would be similarly distorted and oversimplified.

Although Centers has made a very remarkable contribution to the empirical investigation of stratification, particularly in his discovery of political and other attitudinal correlates of occupational strata based upon a nation-wide sample, it would appear that his conclusions as to the psychology of class consciousness are unwarranted.

3. Wayne Wheeler[5]

Here again, the two empirical studies complement each other to an unusual degree, as did the two theoretical works of Parsons and Weber. Centers makes full use of the analysis of criteria, correlates, and characteristics of the ascriber, but does not allow the actor-ascriber to differentiate in his own way. Wheeler allows the actor-ascriber almost complete freedom to differentiate the way he pleases and then does not analyze the data. Perhaps the most striking thing about the whole study is that he does not recognize multiple systems even when the actor ascribers see anywhere from three to eight classes.

The function of the paradigm in the following construction of researchable hypotheses is demonstrated by the following representative hypotheses and suggestions for research:

1. Ascribers within an interaction system (actor-, informant-, and self-ascribers) will be more apt to perceive multiple structures, and complexity within those structures, than will ascribers who are outside that interaction system (scientist-ascribers). This same relationship

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will apply within the two sub-types of ascribers, depending upon the degree of interaction with the ascribees: actor-ascribers and self-ascribers will perceive more complexity than informant-ascribers; observer-ascribers more than reporter-ascribers; observer- and reporter-ascribers more than objective-ascribers.

Research suggestion: In a given community each of the above types of ascriber will report his view of the social structure and the resultant reports will then be compared for differential perceptions of the complexity of the social structure.

2. The actor- or self-ascriber's view of the structure will vary with his segment as well as with his stratum. In general he will make more differentiations in those positions near him and fewer among those far from him.

Research suggestion: Compare the perceptions and differentiations made by ascribers in various occupations with those of ascribers in other categories of occupation which differ both horizontally and vertically from those of the first set.

In conclusion it may be said that the whole dissertation has attempted to make contributions and fill needs in several important areas. First, as the title suggests, it has been a demonstration in theory construction. It appears to the present writer that such an over-all scheme and theoretical methodology as described here could profitably be applied to other areas of the social sciences. The general rationale and the step-by-step description of the processes were designed and intended to serve this function, and it is hoped that the attempt was carried out in a way which suggests application elsewhere.

Second, and more specifically, the dissertation has been aimed at the codification and clarification of the area of social differentiation. Although the testing of unique hypotheses is a legitimate scientific activity, it is felt that the construction and testing of related hypotheses will lead more rapidly to the development of an integrated empirically demonstrable theory of social differentiation. It is hoped that the paradigm so organizes areas of variables as to facilitate recognition of the place of unique and related hypotheses in a larger framework. Although random combination of variables may often result in hypotheses which are important to general theory, it is believed that systematic combination will more rapidly lead to this result.

Third, the dissertation fills the need for a broader frame of reference for critical analysis of works in the field. The usual critiques and analyses of research and theory in the area of social differentiation have been primarily concerned with attacks upon or defenses of fairly narrow ranges of concepts and findings. Very often the critic will merely substitute his own convictions about what social structure really is for the author's. Seemingly opposite points of view are often the result of semantic confusion, and one set of definitions may be substituted for another without materially changing the conceptualization. Criticisms are frequently destructive without offering any substitution of more appropriate ways of solving the problem to which the author has addressed himself.

It is thought that the codification of concepts and the more concise operational definition of terms, as well as the illustration of their application in critical analysis, will facilitate the comparative and separate evaluations of contributions in the area of social differentiation. The glossary is an effort in this direction, and it is hoped that standards have been suggested with respect to the use and meanings of terms which will find wide application.

227 pages. $2.95. Mic 58-4490

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2. Henderson, A. M., and Parsons, Talcott, editors. Max Weber: The Theory of Social and Economic Organization. New York: Oxford University Press, 1947, pp. 250-54, 424-29.

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Abstract published by special arrangement with The Ohio State University.

A CRITICAL ANALYSIS OF ADULT PAROLE PROCEDURES AND THEIR ADMINISTRATION IN THE UNITED STATES OF AMERICA

(Publication No. 24,878)

Dunstan Ivan Nicolle, Ph.D.
New York University, 1957

Adviser: Dr. Paul Tappan

Essentially the dissertation is a structural-functional analysis of the adult parole systems for felons in each of the fifty jurisdictions of the continental United States. The objectives of the analysis are threefold: (a) to indicate that the concept "parole system" is more of a semantic generalization than an objective and uniform category, (b) to draw attention to the fact that the statutory directives in most jurisdictions are archaic and ill-formulated and help perpetuate the anarchy in parole, (c) to indicate the urgent need for redirection and reformulation of legal norms in accordance with contemporaneous criminological thinking.

The analysis indicates that even where the various parole systems are structurally similar, there are functional differences and where there exist functional similarities there are usually structural differences. The impression of exclusivity and difference is therefore, confirmed and sustained. In the context of the American social system this exclusivity and difference in parole systems is both anomalous and self-destructive, and has to be remedied.

Generally this implies the rejection of archaic laws and regulations and the acceptance of legislation that is not only in harmony with contemporary social behaviour, but which provides explicit direction to the administrative bodies in charge of parole. Specifically, it implies (a) professionalization of the parole system, (b) the development of new patterns of sentencing, (c) the acceptance of standardized procedure in the form of parole preparation and in the parole hearing itself, (d) the formulation of

realistic regulations governing conduct on parole, (e) the preservation of certain essential tenets of justice during parole revocation proceedings.

The position taken throughout the analysis is that parole must no longer be looked upon as a matter of privilege but as a correctional necessity. This requires important changes in the laws which bring the system into operation and has far-reaching implications in every aspect of parole. As long as parole was considered a matter of privilege, the law could be generic and nebulous. But the more dynamic view requires specificity and standardization.

The evidence in support of these propositions is drawn from an analysis of six critical areas, (a) the parole structure, (b) the functioning of the parole system, (c) minimum eligibility requirements, (d) parole processing and the nature of the parole hearing, (e) parole revocation and its implications, (f) termination of the parole process and the act of final discharge. The approach is comparative and macroscopic. 404 pages. $5.15. Mic 58-4491

THE AMERICAN CITIZEN-SOLDIER: A SOCIOLOGICAL ANALYSIS OF WAR NOVELS

(Publication No. 25,152)

Harry Posman, Ph.D.
Columbia University, 1957

In this investigation American novels about the second World War are used as a source of hypotheses and as an aid in locating major variables relative to social life in the army. The design provides for a comparison with social science studies to permit evaluation of some of the hypotheses derived from the novels, and the location of areas of bias as well as the contributions of the war novelists toward an understanding of the individual and organizational aspects of the army.

Twenty-nine American war novels were located which portray primarily interaction between male members of the U. S. Army during the second World War. A guide was designed which called for information concerning 1) the civilian and the army status characteristics, and the ideological orientations of the forty major characters in the war novels, 2) the adjustment problems and responses of these fictional characters, and 3) interaction patterns in which they became implicated with superordinates and subordinates, and with equals in rank in the army. A reanalysis of some of the novels during an early phase of the study suggested areas of low reliability, resulting in modification of the guide and elimination of obviously unreliable categories. The primary source material for the empirical data is the survey studies summarized in S. A. Stouffer et. al., The American Soldier (Vols. I & II), supplemented with accounts based on participant observation by social scientists in the army.

The status characteristics of the fictional protagonists as a group correspond fairly closely with those of the soldiers in the U. S. Army during the war, though the novelists tend to overrepresent individuals with an urban background, officers, and men serving overseas, in combat, and becoming casualties. The attitudes and beliefs of the major fictional characters toward the war and the army correspond with survey findings concerning the attitudes of the majority of American soldiers. The dominant orientation in most of the fictional accounts involves lack of ideological articulation, a conception of war as a necessary evil, and condemnation of the army as an organization using men as instruments rather than as ends.

One of the major themes in the war novels is an account of how American civilians coped with army life. In the fictional case studies clues for empirical research were located concerning the dynamic process of adjustment to the status serials of civilian to soldier, and non-combat to combat soldier. The novelists tend to emphasize differences, rather than similarities, between civilian and army life, stressing even more than the social science studies the authoritarian organization of the non-combat army, its highly stratified social system, and its emphasis on traditional ways of doing things as sources of conflict. The fictional accounts are especially suggestive concerning the process of adjustment to the requirements of combat.

The novels are a rich source of hypotheses relative to interaction since both verbal and non-verbal behavior are described within the context of changing patterns of relationships. The fictional accounts suggest that imposed patterns of behavior occurred more frequently in the rear, while in the combat zone resistance to those official army practices which were perceived as not clearly related to the needs and interests of the men involved, was greater and more effective. Though the informal structures which emerged are described as an indispensable element to secure army objectives, more frequently they are depicted as an instrumentality of defense against formal demands perceived as incompatible with the need-dispositions, value-orientations, and other role obligations of the citizen-soldier. 248 pages. $3.20. Mic 58-4492

SOCIOLOGY, PUBLIC WELFARE

FACTORS IN COMMITMENT OF EDUCABLE MENTALLY HANDICAPPED CHILDREN TO ILLINOIS STATE SCHOOLS

(Publication No. 25,226)

Robert Arthur Henderson, Ed.D.
University of Illinois, 1957

The purposes of this investigation were: (1) to examine the characteristics of educable mentally handicapped children committed to the Illinois State Schools during the period 1947 - 1956, and (2) to determine the relationship of the presence or absence of special classes for the educable mentally handicapped in the public schools to the rate of commitment of such children to the State Schools.

The study included every child aged 6 - 18, with an IQ of 50 - 85, admitted to either of the two Illinois State Schools (Lincoln or Dixon), during the ten years from July 1, 1946 to June 30, 1956. The characteristics of the population were studied in terms of age on admission, reason for commitment, intelligence quotient, sex, race, religion, and size of community from which committed.

Data were also obtained from other sources regarding

the size of the total school population in each county, and whether or not special classes for the educable mentally handicapped were available in that county during the year in which the child was admitted to the State School.

During the period studied, 1,423 educable mentally handicapped children were admitted to Illinois State Schools. The major findings concerning the characteristics of this population may be described as follows:

1. More boys than girls were admitted (significant beyond .001 level; Chi Square test).
2. The distribution of the population by age showed that the number of admissions steadily increased from age 6 to 16, with the peak at ages 15 - 16 (significant beyond .001 level; Chi Square test).
3. The average IQ of the group admitted to the State Schools was lower than the average IQ of children typically accepted in special classes in the public schools (significant beyond .001 level; Chi Square test).
4. Commitments from Chicago were treated separately from those of the rest of the State. In the downstate area, on the average the rate of commitment of educable mentally handicapped children to State Schools varied directly with the size of the community.

The study of factors related to county commitment rate of educable mentally handicapped children revealed the following:

1. The incidence of special classes for the educable mentally handicapped in the public schools was found to be positively related to county school population size. Few counties with less than 3,000 school children had special classes, while all counties with over 10,000 had some special class services.
2. Counties of 3,000 to 10,000 school population with special classes showed a decrease in rate of commitment from the first to last half of the ten year period studied.
3. Counties of 3,000 to 10,000 school population, as above, without special classes showed a slight increase in commitment rate of educable mentally handicapped children to State Schools during the same period.

Thus the data furnished some limited evidence to support the hypothesis that special class provisions in a community are associated with a decrease in commitment of educable mentally handicapped children to State Schools.

In the final chapter, some implications for state planning--both in State Schools and in public school special classes--are offered, and suggestions for future research are made. 93 pages. $2.00. Mic 58-4493

SOCIOLOGY, RACE QUESTION

UTILIZATION OF NEGRO TEACHERS IN THE COLLEGES OF NEW YORK STATE

(Publication No. 25,148)

James Allen Moss, Ph.D.
Columbia University, 1957

The utilization of Negro teachers in New York State is surveyed for the ten year period 1945 - 1955.

This study reports the findings of interviews conducted with thirty-two (32) of thirty-nine (39) Negroes holding full-time teaching positions in non-segregated colleges in New York State. Also reported are interviews conducted with twenty-six (26) of thirty-four (34) deans and departmental heads in the colleges employing Negro faculty members. In addition to one teacher already included in the sample, three other Negro college teachers whose careers reflect the development of college teaching as a profession among Negroes were interviewed for this study. All of the interviews were conducted during the period between April, 1956 and April, 1957. Interviews with the Negro teachers were recorded by tape and took approximately one hour to record. The interviews with the administrators took about forty-five minutes.

It is suggested by this study that the utilization of Negro teachers in white colleges has historically followed a pattern similar to that observed in the extension of opportunities for Negroes within the broad social and cultural framework of American society.

It is also suggested by this study that Negro college teachers, except for the early 1900's, have become qualified and available for teaching positions in white colleges at a pace faster than they have been absorbed into these institutions. At least three factors have been isolated in the study as contributing to this "lag": reluctance or hesitancy on the part of Negro teachers to apply for positions in non-segregated institutions, even where such doors have been open to them; reluctance or hesitancy on the part of white institutions to recruit in Negro colleges for able Negro teachers as additions or replacements for their faculty; and reluctance or hesitancy on the part of a predominant segment of white American society to accept the Negro as an intellectual and social equal.

In this study profiles of the Negro academic man in both segregated and non-segregated colleges are compared with his white colleagues teaching in the same kinds of institutions. The Negro teacher in the white college in New York State appears to have come from a relatively secure socio-economic background, holds the Ph.D. degree from a major institution, felt challenged and optimistic about his opportunity to teach in a non-segregated institution, came into his present position with better training and more teaching experience than his white colleague, yet almost invariably entered at the instructoral rank, has been in his present position about ten years, is concentrated, for the most part, in the four municipal colleges of New York City, and expresses the professional aspiration of "going up the ladder" in his present institution.

Finally, college teacher integration is contrasted, both in terms of how the process was carried out and the speed in transition, with expanded programs of utilization of Negroes in such areas as The Army, housing, public schools and professional baseball.

It is felt that with New York State employing the largest number of Negroes in non-segregated colleges, this study has relevance and implications for college teacher integration in states other than New York.

321 pages. $4.15. Mic 58-4494

AN EVALUATION OF TWO PULSE-TYPE TESTS OF HEARING

(Publication No. 23,695)

Thomas Brown Anderson, Ph.D.
The Ohio State University, 1952

An experimental study was designed to evaluate two pulse-type tests of hearing, particularly as screening tests of auditory acuity. The two tests which were evaluated were pure-tone and white-noise pulse-type tests. Two tests that are commonly accepted as tests of hearing acuity were used as criterion measures for the evaluations: a pure-tone audiometric-type threshold test and a spondaic speech-reception test.

The measurement of various aspects of hearing was undertaken early by experimental psychologists and psychophysicists in their study of sensation. Bekesy reports that audiometric measurements were made by Sauveur in 1700.[1] Sauveur used organ pipes in testing the frequency limits of hearing and set the limits at 12.5 and 6,400 cycles per second (c.p.s.).

The study of the measurement of hearing has continued. An applied branch of the study has led to clinical otology and audiometry. It is with this aspect of the measurement of hearing that the present study is concerned. One of the first tests of hearing acuity in clinical procedures apart from the psychological laboratory was the voice and whisper test. Goldstein, an otologist, wrote in 1924 that because voices vary so greatly in pitch, intensity, and character, it is impossible to formulate standards for testing, and approximate standards must suffice in the administration and interpretation of the voice test.[2] Kopetsky describes a commonly used voice test in which the normal distance from the speaker to the listener for conversational voice is 20 feet.[3] He notes the sources of error in this test and concludes that for accurate measurement of hearing losses, the voice and whisper tests have little value. He emphasizes, however, that since the ability to hear normal speech is the prime interest of the deafened person, these results should not be discarded but only subjected to more rigid control.

Other early tests of hearing were the monochord, the coin-click, and the watch-tick tests. Fletcher demonstrates the limitation of the watch-tick and coin-click tests by pointing out that these tests present frequencies of limited range, centered at 2,000 c.p.s. and that frequencies of this range set up disturbing reflection patterns in normal rooms.[4]

Bunch summarizes the role of tuning forks in the development of otology.[5] Certain fork tests, such as the Weber, Rinne, and Schwabach, developed in 1834, 1855, and 1890, respectively, are widely used diagnostically by otologists. Bunch states that the lack of standardization (of watch tests, tuning forks, etc.) was a principal reason for the development of the electrical audiometer. A vacuum tube audiometer, the Western Electric 1-A, became available commercially in 1922. It was bulky and almost prohibitive in cost; few were produced. Audiometers are now easily portable (25 pounds) and priced within the budgets of professional workers and schools. They are basically pure-tone oscillators with provisions for conveying speech at controlled levels. Availability of audiometers, ease of operation, and possible validity of the tests may account for the current popularity of pure-tone and speech audiometers in determining hearing loss and for the current practice of testing the hearing of large numbers of people, like school populations. There has been controversy concerning the relationship of speech tests and audiograms. Guilder reported high correlation between hearing tests for speech and the audiogram.[6] Fletcher has worked continuously to make all aspects of measurement of hearing more exact.[4] He developed tables of the relationship between sensation units of hearing loss and the corresponding distances for hearing speech of various levels. More recently he has devised a method of predicting the speech-reception threshold from the pure-tone audiogram.

Carhart studied the relationship between loss for speech reception and loss for pure tones.[7] He reported high positive correlation except for cases with marked high-frequency loss. Fowler states that because of such factors as "word deafness" and wide differences in ears, the audiogram is not sufficient for measuring hearing capacity.[8]

One of the steps in testing large numbers of people is to separate people who have gross hearing loss, those who obviously have no hearing loss, and a third group who are borderline. This is called screening. Screening is frequently done by setting the hearing loss dial of a pure-tone audiometer at a level within the normal hearing range and rapidly progressing through the frequency range of the audiometer. The listener indicates whether or not he hears the successive tones. Modifications of this technique permit testing several people at one time. Gardner describes such a test used as a basis for the 1939-40 World's Fair Tests.[9] Reger and Newby devised a multiple pure-tone test in which tones were delivered according to a prearranged pattern, one, two, or three times at various levels of intensity.[10]

In recent years a number of speech tests have been devised for measuring thresholds for speech. One of the best known of these is the Harvard Word Lists developed by the Psycho-Acoustic Laboratory of Harvard University. Watson writes that the spondaic words used in the Harvard Test Number 9 are the most useful material for speech-reception tests, whether recorded at a constant level or attenuated.[11]

The present study attempted to evaluate two pulse-type tests of hearing. One of these, a multiple-tone pulse-type test, was originally administered as a screening test to incoming male students as part of the physical examination for men during Orientation Week at the Ohio State University in September, 1951. The recorded test included

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instructions and tone pulses of one-half second's duration for the frequencies 500, 1,000, 2,000 and 4,000 c.p.s.

The other test which was evaluated was a single-tone pulse-type and white-noise pulse-type test. It was designed at the School of Aviation Medicine, Naval Air Station, Pensacola, Florida, and was used originally as a test for hearing after prolonged exposure to noise. The single-tone test consisted of a series of from two to four pulses of a 500 c.p.s. tone attenuated in two db steps for a series of ten groups of pulses. The white-noise test was a series of from two to four bursts of white noise attenuated in two db steps for a series of ten groups of pulses. The level of the tests was set so that for average normal ears the last two series of tones and noise would not be heard.

Two other tests were used as criterion measures in evaluating the tests under study. One was a pure-tone audiometric-type test given in one db steps to determine detection thresholds for each ear for the 500, 1,000, 2,000, and 4,000 c.p.s. frequencies. The second test was the Harvard Auditory Test Number 14, a spondaic-word list used to determine speech-reception thresholds. It was administered in free-field conditions. The level (db relative to .0002 dynes/cm.^{2}) at which the listener repeated correctly 50 per cent of the words was designated the speech-reception threshold.

One hundred nineteen male subjects participated in the experiment. They were chosen as a result of having failed to make a perfect score on the multiple-tone pulse-type test in the Men's Gymnasium during Orientation Week in September, 1951. Each subject was given five tests under laboratory conditions. These tests were the multiple-tone pulse-type test, the single-tone pulse-type and white-noise pulse-type test, the pure-tone audiometric-type test, the speech-reception test, and a multiple-choice word-intelligibility test that was not evaluated in this study. A total of 23 scores was obtained for each subject.

Nine hypotheses were formulated and tested. I. Scores of the pure-tone test categorized on the basis of perfect and imperfect scores are unrelated to the speech-reception test scores when categorized into higher half and lower half of scores. II. On the basis of pure-tone scores for a given frequency for a particular ear, there is no difference in the means of the groups when subjects are grouped according to scores on the multiple-tone pulse-type test. III. On the basis of speech reception scores, there is no difference in the means of the groups when subjects are grouped according to three categories of the multiple-tone pulse-type test. IV. On the basis of perfect and imperfect scores, the scores of the original multiple-tone pulse-type test as administered in September, 1951, and those of the same test under laboratory conditions are unrelated as measures of hearing acuity. V. On the basis of perfect and imperfect scores, scores of the multiple-tone pulse-type test and retest under laboratory conditions are unrelated as measures of hearing acuity. VI. On the basis of pure-tone scores for a given frequency for a particular ear, there is no difference between the means of the groups when subjects are grouped according to scores on the single-tone and white-noise pulse-type tests. VII. On the basis of pure-tone scores for the better ear, there is no difference between the means of the groups when subjects are grouped according to scores of the single-tone and white-noise pulse-type tests administered binaurally. VIII. Scores of the single-tone and white-noise pulse-type test and the speech-reception tests, when separated into two categories as near the median as feasible, are unrelated as measures of hearing acuity. IX. Scores on the retest of the single-tone and white-noise pulse-type test and scores on the speech-reception test, separated as near the median as feasible, are unrelated as measures of hearing acuity.

Five hypotheses were rejected. The Roman numerals refer to the hypotheses of the same designation in the preceding paragraph. I. A statistically significant relationship was indicated between the speech-reception test and the pure-tone test at each experimental frequency: 500, 1,000, 2,000, 4,000 c.p.s. (statistic: chi-square and bi-serial correlation). II. There was a significant difference among the subjects' mean scores on the pure-tone tests when the subjects were categorized according to their scores on the multiple-tone pulse-type test (statistic: analysis of variance). III. There was a significant difference in mean scores of the subjects' speech-reception scores when the subjects were grouped according to their scores on the multiple-tone test (statistic: analysis of variance and bi-serial correlation). V. There was a statistically significant relationship between the subjects' scores on the multiple-tone test and on a retest, both administered under laboratory conditions (statistic: chi-square and tetrachoric correlation). VI. There was a significant difference in the means of the subjects' scores when the subjects were categorized according to their scores on the single-tone and white-noise pulse-type (monaural) test (statistic: analysis of variance).

Four hypotheses were rejected in part. IV. There was a significant relationship between the subjects' scores on the multiple-tone pulse-type test when administered as a screening test in the Men's Gymnasium and the Laboratory: right ear, one per cent level of confidence; left ear, 10-20 per cent level of confidence (statistic: chi-square). VII. There was a significant difference between the subjects' scores assigned by the white-noise pulse-type test and the frequencies of the pure-tone test. There was a significant difference between the subjects' scores assigned by the single-tone test and the 500 c.p.s. frequency of the pure-tone test, none with the 1,000, 2,000 and 4,000 c.p.s. frequencies (statistic: analysis of variance). VIII, IX. There was a statistical relationship between the subjects' scores on the speech-reception test and their scores on the white-noise pulse-type test, none on the single-tone test (statistic: chi-square and bi-serial correlation).

A further test was made to determine the relationship between scores on the multiple-tone pulse-type test and the noise environment in which the test is administered. One hundred forty-four students in elementary speech classes at The Ohio State University were given the multiple-tone pulse-type test. Six groups of 24 subjects each were administered the test in six levels of white noise: 55, 60, 65, 70, 75 and 80 db (General Radio sound level meter, scale C). The subjects took the tests in two specially constructed sound-treated booths. Results of the tests revealed that about 85 per cent correct responses were obtained for the multiple-tone test in noise levels as high as 65 db inside the testing booths.

From the study the following general conclusions may be drawn: (1) A variable-frequency pulse-type test of single sound pressure level is feasible for screening the hearing acuity of university students rapidly. (2) The screening may also be accomplished by a pulse-type test

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utilizing bursts of noise; (3) adequate screening cannot be accomplished through the use of single frequencies, at least of 500 c.p.s.; (4) within limits of 65 db the noise environment of the test is not crucial; (5) scores that correspond to complete failure on the test are not diagnostic and indicate only that an individual test should be administered to the recipients of zero scores.

124 pages. $2.00. Mic 58-4495

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GEORGE L. FOX, COMEDIAN, IN PANTOMIME AND TRAVESTY

(Publication No. 25,210)

Walter Headen Draper, Ph.D.
University of Illinois, 1957

The purpose of this study was to present the discoverable facts about the all-but-forgotten pantomimist and performer of travesty, George L. Fox, who lived from 1825 to 1875, and to determine his significance in the development of comedy on the American stage.

Since theatre historians have recorded little about George L. Fox, and since he wrote nothing about himself or his work, most of the materials for this study came from contemporary newspaper accounts. Other sources of information were family records furnished by Mr. George P. Howard, a great nephew of Fox, and miscellaneous material from public and private libraries in New York City.

Born in Boston in 1825, Fox first appeared on the stage as a child actor at the Tremont Street Theatre in 1830. The next twenty years, with one short interruption, were spent playing throughout New England with the Fox and Howard Family troupe where he developed into a comedian, specializing in Yankee roles.

In 1850 he began acting at A. H. Purdy's National Theatre in New York's rowdy Bowery. Here he extended his experience in low comedy and observed the technique of the Ravel pantomime troupe.

After a four-year partnership with J. W. Lingard at the Old and New Bowery Theatres from 1858 to 1862, Fox undertook sole management of the Old Bowery. He then obtained written scripts of English pantomimes, in which he played the clowns, adding to them the light, nimble trickery of French pantomime as he had seen it performed by the Ravels, and his own droll humor with which he had played countless American Yankee roles. The result was a pantomime style so successful that he attempted a full-length production at a first-class Broadway theatre. Humpty Dumpty, in 1868, enjoyed an initial run of almost five hundred performances and, with various subsequent engagements, a total of nearly twelve hundred presentations.

After two years his version of pantomime began to lose its popularity, and he turned to travesty. In 1870 and 1871 he produced burlesques of Hamlet, Macbeth, and Lytton's Richelieu. Although none of these was very remunerative, the critics appraised his performances in Hamlet and Richelieu as comic art of high order.

Following these travesties he turned again to pantomime. After an extensive road tour of Humpty Dumpty and several only moderately successful attempts to revive the pantomime in New York, ill health forced his retirement in 1875.

Fox took elements of English and French pantomime and made of them a typically American entertainment which for a few years was extremely popular. He raised travesty from crude slapstick to high art. Although after his death, pantomime and travesty virtually disappeared from our theatre as separate entities, elements of them survived in the performances of vaudeville players such as Weber and Fields, Dave Montgomery and Fred Stone, and others. They carried on the tradition of comic acting established by Fox and it still survives in modern musical comedy and extravaganza. As a result, today's audiences accept the low comedy of such performers as Bobby Clark, Ben Blue, Buster Keaton, Jimmy Durante, and Danny Kaye on a basis equal to the best our theatre has to offer. This study indicates that Fox's lasting contribution was to raise the level of low comedy on the American stage.

183 pages. $2.40. Mic 58-4496

MAURICE BROWNE AND THE CHICAGO LITTLE THEATRE

(Publication No. 25,211)

Bernard Frank Dukore, Ph.D.
University of Illinois, 1957

From 1912 through 1917, Maurice Browne produced plays at the Chicago Little Theatre. Although his work received much attention during and shortly after the lifetime of the Chicago Little Theatre, it has received little

attention since. This study is designed to correct that neglect by examining the nature and significance of that work.

Most of the material was drawn from Chicago newspapers of the period 1912-1917. The most informative single author was Maurice Browne, particularly his Too Late to Lament and The New Rhythmic Drama. Important, too, were the writings of Gordon Craig, which directly influenced Browne. Collections of unpublished material at the University of Michigan, Harvard College, and the New York Public Library provided some information. Correspondence and interviews with ex-members of the Chicago Little Theatre, including Alice Gerstenberg, Cloyd Head, Raymond Jonson, John Martin, Daniel Reed, and Ellen Van Volkenburg were very helpful.

The study is introduced by a consideration of the dissatisfaction with the American commercial theatre in the early part of this century and by a history of the Chicago Little Theatre. Browne's work is then analyzed in terms of the play, the theatre building, the actor, the director, the scenery, the lighting, and his attempt to develop an art theatre technique. An evaluation of this work concludes the study.

While the commercial theatre produced the works of soon forgotten playwrights, Browne, with a company of unsalaried amateur actors, on a stage fifteen feet wide and eighteen feet deep, in an auditorium seating ninety-three people, produced the works of such playwrights as Euripides and Yeats. Browne followed Gordon Craig's advice on unity of production under a single director, and was the absolute ruler in his theatre. He also followed Craig's advice on scenery and lighting. He rejected naturalistic scenery and created scenery that had simplicity, suggestiveness, and beauty. He employed lighting to enhance the emotional and pictorial values of the play, and experimented with arbitrary lighting for emotional effect.

In addition, Browne attempted to develop a technique of play production peculiar to an art theatre: the rhythmic drama. He integrated the static rhythm of scenery with the active rhythms of light, movement, and sound on a plane of conventionalization. Browne wanted to bring poetry back into the theatre not only in the words of the playwright, but also in color, line and mass, movement, and the relation and spacing of actors.

For the most part, Browne was not an innovator, but an early practitioner. He was the first in America to eliminate footlights as a matter of policy and to use emotional lighting. He appears to have influenced the American theatre because his productions were widely known. He wrote of his theories and others wrote of his productions in national magazines. Not only did his company make annual tours to such cities as Boston and Milwaukee, but in 1915, his production of Euripides' The Trojan Women toured the length of the United States and gave many areas of this country their first glimpse of simplified scenery, new lighting techniques, and the achievements of a non-commercial and non-professional theatre. Browne influenced today's theatre specifically through the Provincetown Players and the Washington Square Players, the original members of which were familiar with his work at the Chicago Little Theatre. Browne was called the founder of the little theatre movement. Although he was not the first little theatre in America, people thought of him as the founder of the little theatre movement, and drew inspiration from his example. 156 pages. $2.05. Mic 58-4497

THE RELATIONSHIP BETWEEN PHONETIC PATTERNS OF INDIVIDUALS WITH SUPERIOR, AVERAGE, AND POOR ARTICULATION AND THEIR PREFERENCES AMONG CONTROLLED SPEECH-SOUND STIMULI

(Publication No. 23,693)

Rita Scott Griffith, Ph.D.
The Ohio State University, 1952

An investigation was conducted to determine the relationship between phonetic patterns of individuals with inferior, average, and superior articulation and their preferences among controlled speech-sound stimuli.

Persons having articulatory defects make up the largest group seen in the college speech-rehabilitation center.[1] Most of these errors are functional; they have no organic etiology. The causes of articulatory defects are numerous and complex. Defective hearing is known to be a cause of defective articulation.[2] Inability to discriminate between the sounds of speech has been indicated as another possible cause of articulatory errors.

Travis and Rasmus[3] found that persons having defective articulation missed a significantly greater proportion of syllabic discriminations within pairs of syllables than those persons who had nó articulatory errors in their speech. Templin[4] studied the effect of the position of the sound to be discriminated within a syllable on the speech-sound discrimination ability of the subject having defective articulation. The results of this study demonstrated that fewer errors in sound-discrimination were found when the discriminative element was placed in the initial position within a syllable. The greatest difficulty in discrimination occurred when the discriminative element was placed in the final position in a syllable. Reid[5] found the highest correlation, among causal factors of articulatory errors, between the speech-sound discrimination scores and the ratings of the articulatory ability of her subjects. Hall,[6] in a study of speech-sound discrimination ability, found no significant difference in ability between subjects with defective articulation and subjects with normal articulation. The study tested two groups of subjects, children and adults, on two types of material, paired syllables and nonsense syllables within phrases. Hansen[7] and Mase[8] also concluded that there was no significant difference between the speech-sound discrimination ability of untrained subjects who had defective articulation and subjects who had normal articulation.

In spite of the equivocal nature of the results of studies on speech-sound discrimination ability, practical clinical experience seems to indicate that there is some difference between the ability of the individual with defective articulation and the ability of the normal speaker to differentiate between the sounds of speech. If normal hearing is determined in the articulatory defective, can faulty speech-sound discrimination be cited as a cause of articulatory defects in the young adult? Or are the errors attributable to an unconscious preference on the individual's part for that which is his own? Is the sound pattern of his own speech or a phonetic pattern similar to his the most acceptable to his ear?

The completed studies on speech-sound discrimination and related observations from practical experience led to the formulation of a study designed to test the relationship between the phonetic patterns of individuals judged as

having inferior, average, and superior articulation and their preferences among controlled speech-sound stimuli. The four sounds selected for study in this experiment were [s], [ʃ], [tʃ], and [θ]. The experimental subjects were divided into categories as inferior, average, and superior articulators by a panel of four criterion judges. A set of 72 pairs of syllables for each of the four sounds which were studied was devised. The 72 syllabic pairs were composed of nine original syllables paired in random order and previously rated on a scale from inferior to superior by judges who were experienced in phonetic discrimination. The experimental subject was asked to select one member of each of the 72 pairs of syllables as his preference.

Four general hypotheses were formulated for testing:

1. There is no difference among the preferences of individuals with inferior, average, and superior articulation of [s] for controlled [s] speech-sound stimuli.
2. There is no difference among the preferences of individuals with inferior, average, and superior articulation of [ʃ] for controlled [ʃ] speech-sound stimuli.
3. There is no difference among the preferences of individuals with inferior, average, and superior articulation of [tʃ] for controlled [tʃ] speech-sound stimuli.
4. There is no difference among the preferences of individuals with inferior, average, and superior articulation of [θ] for controlled [θ] speech-sound stimuli.

A related hypothesis formulated for test was:

5. There is no relationship between the scores on the speech-sound preference tests of [s], [ʃ], [tʃ], and [θ] and intelligence as measured by the Ohio State Psychological Examination.

Tests of these hypotheses involved (A) construction of a scale for each sound which was studied; (B) preparation of phonetic materials for the experiment; (C) selection of experimental subjects; (D) administration of the phonetic materials, in the form of a preference test, to the experimental subjects; and (E) application of statistical techniques to evaluate significance of difference among preferences of inferior, average, and superior articulators for controlled speech-sound stimuli.

Samples of the syllables, [is], [iʃ], [itʃ], or [iθ], produced by speakers who ranged in articulatory ability from inferior to superior, were recorded on a tape recorder-reproducer. The [i] in each syllable was deleted, and an [i] recorded and reproduced by one speaker was inserted. Twenty of these syllables for each sound were heard by a group of 24 judges. They were asked to scale these variations on a seven-point scale from inferior to superior. If 70 per cent of the total 24 judgments of the variation fell within the modal value and the two adjacent scale positions (the one above and the one below), the syllable sample was retained for the preparation of materials for the preference test which was administered to experimental subjects. Nine syllables for each sound were found to meet the above criterion.

These nine syllables were then paired in random order, yielding 72 pairs for each sound. They were recorded on disc, and composed the preference test employed in this experiment.

Two hundred fifty-three subjects (male and female undergraduates in the Ohio State University) recorded samples of [s], [ʃ], [tʃ], or [θ] in the final, medial, and initial positions within nonsense syllables. These recorded samples were evaluated as inferior, average, or superior articulations by the experimenter and a group of three criterion judges. If three of the four evaluators placed a sample in the same category of articulatory ability, the individual who had produced it was retained as a subject in the experiment. Employing this criterion, the evaluators agreed on 192 subjects who were retained as inferior, average, and superior articulators of [s], [ʃ], [tʃ], or [θ].

These subjects then heard the recording of the 72 syllabic pairs of the sound for which they were selected. They were asked to state their preference for the first or second member of each pair.

The initial method of scoring was based on agreement or disagreement with the scale values originally assigned by the judges in all pairs in which one member of a pair had a higher scale value than the other member. In addition, several other methods of scoring were employed; they were based on various scale position differences within the pairs and on agreement or disagreement of response with the scale ratings given to the items by subjects rather than by judges.

The scores were arranged in columns, and the statistical method used was analysis of variance. Each score served as a basic measure in these analyses. Data obtained from preference tests of each of the four sounds were treated individually.

The mean percentage scores of the inferior, average, and superior articulators indicated that average articulators seemed to have numerically a higher percentage of agreement with both judges and other subjects than did inferior, or superior articulators. Analyses of variance performed to test the significance of difference among inferior, average, and superior articulators of [s], [ʃ], [tʃ], or [θ] on the preference tests yielded non-significant results in all methods of scoring. These results would not cause rejection of the hypothesis, "There is no difference among the preferences of inferior, average, and superior articulators for controlled speech-sound stimuli."

Scores of subjects on the speech-sound preference tests were correlated with scores of subjects on the Ohio State Psychological Examination by employing the Pearson product-moment r. The correlation was not significant, and did not lead to rejection of the hypothesis, "There is no relationship between the speech-sound preference test scores and intelligence as measured by the Ohio State Psychological Examination. 121 pages. $2.00. Mic 58-4498

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THE IMAGE OF JAPAN IN THE SPEAKING OF UNITED STATES CONGRESSMEN, 1941-1953

(Publication No. 24,908)

Leslie Ray Kreps, Ph.D.
Northwestern University, 1957

Adviser: Franklyn S. Haiman

This study surveys the speaking of United States Congressmen to discover the "image" of Japan contained therein. By "image" is meant the assumptions as to national character upon which speaking about Japan is based.

A discernable correlation was discovered between the accuracy of the image of national character held by our legislators and the constructive or destructive nature of the policies advocated. Speaking on relocation of Japanese-Americans was illustrative of the "low accuracy image - destructive policy" correlation. West coast Congressmen brought a racial stereotype to the relocation debate. Because Japanese-Americans were viewed racially, the speaking of many Congressmen presented an image of the Japanese -- all Japanese -- as being treacherous, dishonest, "atheistic," and uncivilized. Total relocation was possible only because such a racial stereotype was accepted.

The opposite correlation -- that between high image accuracy and constructive policy formation -- can be seen in the speaking of Congressmen who defended the rights of Japanese-Americans. Some Congressmen opposed deportation legislation on the grounds that the Japanese racial stereotype, as applied to Japanese-Americans, was inaccurate.

The psychological warfare broadcasts to Japan by Senator Elbert D. Thomas of Utah also revealed high image accuracy. A former missionary to Japan and Far Eastern scholar, the Senator brought to his task of persuading the Japanese that war against the United States was inimical to the interests of both Japanese and Americans a knowledge of the Japanese people acquired over a lifetime of intimate relationships with them.

Congressional speaking concerning Japan between 1950 and 1953 produced a mixed image as far as its accuracy was concerned. Most Congressmen realized that Japan, a sovereign ally, would be more helpful to the free world than would Japan, an occupied puppet. Such an image was accurate. But, in line with our need for fully armed allies, the majority of Congressmen put a gun in the hand of the Japanese image they saw. This corresponded neither to the Japan in being nor the Japan which a majority of Japanese wanted to see.

This rhetorical study suggests certain areas for further research:

1. The analysis of the Thomas broadcasts would suggest that the image concept method may be one means of systematizing the procedures of propaganda analysis. After classifying the broadcasts as to central themes, the image can be deduced from the principle lines of argument used by the propagandist to prove his points. A judgment as to the accuracy of this image can then be made. Such a judgment should be based upon detailed evidence rather than upon mere general impression.

2. Further study is suggested by the nature of debate on relocation, described in this study as delayed-clash. For eighteen months, only affirmative advocates spoke. For five months -- beginning in October, 1943 -- there was direct clash. Then the negative, those defending the rights of Japanese-Americans, predominated. The question raised is, "Are other controversial issues debated in a similar delayed-clash form?"

3. Further research is suggested concerning a matter of invention in Congressional address. A large percentage of the Japan image producing material was completely or predominantly quoted. Is this equally true of speaking concerning other subjects about which Congressmen have little first-hand experience?

370 pages. $4.75. Mic 58-4499

BUSINESS AND THE BUSINESSMAN IN AMERICAN DRAMA PRIOR TO THE CIVIL WAR

(Publication No. 25,379)

Charles Raymond Lown, Jr., Ph.D.
Stanford University, 1957

This dissertation was planned to investigate the early American drama in order to determine: (1) how the various businessmen in the plays were characterized; (2) what the attitudes were toward these businessmen as revealed by a study of the plays; and (3) the relationship, if any, between business in the plays and the concurrent economic conditions of the nation.

The writer found one hundred forty plays that contained businessmen characters. Forty-eight plays of this number included businessmen whose occupations were a factor in character and/or plot development. It was found that all businessmen fell easily into three general categories which served as a basis for the three chapters of the dissertation. Each chapter was further subdivided. Chapter I is concerned with the Merchant, and included in this section of the dissertation are older merchants-good, older merchants-foolish, older merchants-villainous, younger merchants-good, and younger merchants-foolish. Chapter II emphasizes Bankers, Brokers, Speculators, divided into the following categories: bankers-good, bankers-villainous, brokers-villainous, brokers-foolish, brokers-good, and speculators. Chapter III is concerned with the Small-Business Businessmen, among whom are shopkeepers, innkeepers, Yankee Peddlers, and traders. Each chapter concludes with a summary. A Conclusion, four Appendices (A. A Brief Survey of Business Difficulties During the Critical Period, 1783-1789; B. A Review of the Economic Philosophies of Hamilton and Jefferson; C. A Short Survey of the American "Boom and Bust" Economy to 1860; and D. A Chronological Listing of the Plays Selected for Discussion in the Dissertation), and a Bibliography complete the study.

Each subcategory in the three chapters was scrutinized in terms of the objectives set up for the dissertation.

Analysis revealed, in each instance, character traits common to other categories of the chapter. The terms good, foolish, and villainous had meaning in terms of the businessman's expressed attitude toward others whose happiness, in one way or another, depended upon him. He was termed good if his actions were worthy and aided in the happy resolution of the plot. He was termed foolish if his unwise and frequently precipitate actions momentarily jeopardized the satisfactory outcome of the play. And he was categorized as villainous if his actions anticipated harm to others as he schemed to increase his own wealth.

Each play also was studied for references to economic events contemporary to its period of writing or first production. References to economic disturbances, to frauds, to well known businessmen or businesses were noted as they appeared in the plays.

The analysis of the plays revealed definite and consistent attitudes toward each category of businessmen. The Merchant emerged as a businessman whose decisions were ethically right in most instances; the Banker and his cohorts were usually regarded as dishonest men who preyed upon the weak and less affluent; and the Small-Business Businessmen, in a majority of the plays, were regarded with suspicion since they were pictured as adopting dishonest schemes to increase their profits.

Interest in the businessman and in business was closely linked to economic conditions. One-half of the plays studied were presented during a total of but fifteen years time that touched all the principal periods of economic unrest to 1860. The profit motive, in most instances, became the basis for reprehensible acts, and the amount of emphasis placed upon the businessman's methods determined the degree to which he was characterized as villainous.

This study established a definite relationship between business and the businessman as presented in early American drama and the concurrent economic conditions. It indicated that the dramatist, while using trite plots, took advantage of current economic events to make the plays more meaningful to his audience.

329 pages. $4.25. Mic 58-4500

THE USEFULNESS OF THE ELECTRO-LUNG IN MODIFYING THE BREATHING AND SPEECH OF SEVEN ATHETOID CHILDREN AND A RESPIROMETRIC STUDY OF THEIR REST BREATHING PATTERNS

(Publication No. 24,917)

William Harold Plotkin, Ph.D.
Northwestern University, 1957

The study was undertaken in an attempt to evaluate changes which might be brought about by Electro-Lung therapy in the respiratory patterns of seven tension athetoid children. The resulting changes were investigated to ascertain the effectiveness of breathing therapy. In conjunction with the consideration of the effects of Electro-Lung therapy, the breathing patterns of the experimental group were also studied. The respirometer was utilized to collect the information on breathing and all data were converted to standard terms by using the appropriate formulae. The speech of the seven subjects was evaluated before and after breathing therapy.

The seven children in the experimental group were in residence at the Illinois Children's Hospital School in Chicago, Illinois. These subjects received twenty-five half-hour therapy sessions with the Electro-Lung. A series of respirometric tracings was made on each subject: eleven respirometric tracings prior to Electro-Lung therapy, twelve tracings during the seven weeks of Electro-Lung therapy, three tracings on the three days immediately following termination of therapy, one tracing two weeks after and one tracing four weeks after the termination of therapy. In addition to the respirometric tracings, speech recordings were made on each subject the day before the start of Electro-Lung therapy, the day following the termination of therapy and four weeks after the termination of therapy.

The respirometric tracings made before and after breathing therapy were used in making the following measures: rate of respiration, mean tidal air, oxygen consumption, ventilation, ventilation equivalent, standard deviation and coefficient of variation of inspiratory amplitude, vital capacity and alveolar CO_2 tensions. The speech recordings were judged for over-all intelligibility, precision of articulation and the ability to sustain phonation. The ability of the experimental group to adapt to respirometric procedures was also investigated.

On the basis of the data obtained during the study, the following conclusions may be drawn:

1. Breathing therapy with the Electro-Lung resulted in improvement, significant at the .05 confidence level, in the following measures.
   a. The vital capacity was increased.
   b. The ventilation equivalent for oxygen was decreased.
2. Throughout the study, the .05 confidence level was required to reject the null hypothesis. The rate of respiration was decreased; this change was significant at the .06 confidence level.
3. Breathing therapy with the Electro-Lung resulted in no significant improvement in the following measures.
   a. The mean tidal air showed no significant change.
   b. The oxygen consumption showed no significant change.
   c. The ventilation showed no significant change.
   d. The standard deviation of inspiratory amplitude showed no significant reduction, indicating that the regularity of individual respiratory cycles had not changed.
   e. The coefficient of variation of inspiratory amplitude showed no significant reduction, indicating that the regularity of individual respiratory cycles had not changed.
4. The over-all intelligibility of speech of the experimental group improved following Electro-Lung therapy.
5. The precision of articulation of the experimental group showed no improvement following Electro-Lung therapy.
6. The ability of the experimental group to sustain phonation was not improved following Electro-Lung therapy.

7. The resting breathing of children with tension athetosis exhibited the following characteristics.
   a. The rate of respiration was higher than normal.
   b. The mean tidal air was higher than normal.
   c. The oxygen consumption was higher than normal.
   d. The ventilation equivalent was higher than normal.
   e. The ventilation equivalent for oxygen was higher than normal.
   f. The standard deviation of inspiratory amplitude was larger than normal.
   g. The coefficient of variation of inspiratory amplitude was larger than normal.
   h. The vital capacity was lower than normal.
   i. The alveolar CO_2 tension was lower than normal.
8. Children with tension athetosis did not show adaptation to respirometric procedures.

156 pages. $2.05. Mic 58-4501

THE SPEECHES OF WAYNE L. MORSE, 1944-51

(Publication No. 25,402)

Cornelius Ayer Sabin, Ph.D.
Stanford University, 1957

The purpose of this study was to examine the speeches of Wayne L. Morse during his first term in the Senate and to evaluate his speaking. The emphasis was placed upon the three types of proof suggested by classical rhetoricians. The writer attempted to discover the comparative importance of these types in Morse's speeches.

Sixty-five speeches as reported in the Congressional Record, newspapers, magazines, or heard by the writer, were examined and analyzed. Representative issues from Morse's speeches over a six-year period were selected; the speeches concerning those issues were the ones studied.

The dissertation includes: an introduction, a biographical sketch, a chapter on logical proof, an analysis of pathetic proof, a chapter on ethical proof, and conclusions.

In Chapter I, the life of Morse from childhood through his first term in the Senate was discussed. Morse's life on a farm, his schooling at several universities, his teaching in Oregon, his arbitration work, and his political life were discussed in some detail. Morse began a career as a speech teacher and debate coach, later taught law and became the dean of a law school, and then entered the Senate. The forces that shaped his later speaking career seemed to have been his farm life and his experiences at the University of Wisconsin. The persons who influenced him most were his mother and two of his college professors.

The study revealed that Morse relied most heavily on logical proof in his first-term speeches. Chapter II dealt with this type of proof. Ethical proof ranked next, with pathetic proof being the least important of the three. There was considerable evidence of Morse's awareness of classical rhetorical principles. He followed those principles for the most part; this work also points out the areas where he did not. Chapters III and IV dealt with pathetic and ethical proof respectively. Morse employed little pathetic proof, but he developed considerable ethical proof.

As a speaker Morse was considered an excellent debater. He was as copious as Cicero and perhaps as vain. He was engaged in a remarkable number of controversies and rejoiced in being independent. He appeared to enjoy a fight whether it was with a newspaper, his own political party, or the opposition party.

The principal issues with which Morse was concerned were: veterans' affairs, foreign affairs, labor questions, power and conservation, and economic matters. He was an ardent internationalist, a friend of labor, a supporter of public power, and a believer in an expanding economy kept vigorous by public works.

As a figure in national life Morse seems to have selected for himself the role of critic. His principal medium of expression was public address.

299 pages. $3.85. Mic 58-4502

SPEECH EDUCATION IN JAPAN IN THE LATTER HALF OF THE NINETEENTH CENTURY

(Publication No. 24,921)

Mitsuko Saito, Ph.D.
Northwestern University, 1957

This dissertation presents an historical study of the development and nature of Speech Education and Public Speaking activities in Japan, as a part of the widespread educational, political, and social changes which occurred during the latter part of the nineteenth century.

The specific period selected, 1872-1890, included not only the greatest interest in Speech training and use of public oral communication, but also many and rapid cultural and governmental changes. In the opinion of some historians, moreover, there are marked similarities between these years immediately following the Meiji Restoration in 1868, and those at the close of World War II. The then-revolutionary principles of the Oath of Five Articles, stated by the Emperor Meiji in 1868, for instance, constitute the first introduction of the concept of democracy to Japan. These Imperial policies, establishing equality in human rights and privileges, were a distinct break from the feudalistic society and government of prior years.

The early chapters establish an historical background and perspective by outlining the major developments in Japanese educational philosophy and administration from the introduction of written characters in the third century, A.D., to the early part of the Meiji Era. Another chapter presenting the life and contributions of Fukuzawa Yukichi, an outstanding educator of the time, brings to sharper focus the immediate educational, cultural and governmental environment for the introduction of Speech.

Fukuzawa learned much of Western culture on two trips to the United States and one to England in the early days of Japan's "Open Door Policy" following Admiral Perry's visits in 1853 and 1854. These experiences, plus the books he purchased, convinced him of the value of Western knowledge for the greater welfare of Japan. As an educator, he was most impressed with the Western spirit of democracy in society and government, and with the use of lectures dealing with public problems.

Fukuzawa gave the initial impetus to Speech, in its Western sense, in the sixth year of Meiji (1873) through discussions with his associates at Keio-Gijuku (his own

school). After this small beginning in Keio-Gijuku in 1873, Mita public speaking hall was erected in 1875 and the public was admitted as an audience.

Though the growing interest in Western ideas seemed favorable to the general adoption of the new techniques, in the early years, however, the use of Speech remained the exclusive interest of scholars and had but little public use. The more progressive leaders, however, did see the possibilities of Speech as a new means of promoting reforms when an appeal to arms was impossible, and thus brought a rapid growth in these politically active years. As a result, most of the speeches were made by the advocates of the civil-rights movement, in opposition to established government policy. While this use demonstrated the effectiveness of Speech in informing the public, it also barred Speech from the governmentally controlled public schools, and made it most vulnerable to opposition from governmental authority; an opposition soon doubly expressed by the suppression of political speeches, and through the defensive use of Kodanshi and priests by those in power.

With no established place in Japanese culture, and no foundation in the governmentally controlled public education, this new form of expression failed to achieve the role expected by those responsible for its beginning.

Yet a residue was left. For Speech, altered in form and utilized in other fields and for other subjects, continued. With the inauguration of the National Diet in 1890, therefore, the people were ready to speak and debate and to use Speech in the service of the public interest and the national welfare. 338 pages. $4.35. Mic 58-4503

ETHICAL QUALITIES IN JOHN MORLEY'S SPEAKING ON IRISH HOME RULE, 1885-1921

(Publication No. 25,290)

Hermann Georg Stelzner, Ph.D.
University of Illinois, 1957

This study examines ethical qualities in John Morley's speaking on Irish Home Rule between 1885 and 1921. The investigation analyses the man, his message, and his language in order to isolate ethical elements and to evaluate their persuasiveness.

John Morley, 1838-1923, had an established reputation as a philosophical, Radical Liberal before he entered the House of Commons in 1883. His reputation as a Liberal newspaper editor, journalist, and biographer influenced his political progress. During his career as a writer, Morley turned his attention to Ireland. In The Fortnightly and the Pall Mall Gazette he advocated that England govern Ireland according to Irish rather than English needs.

Although Morley's temperament and background were more suited to a man of letters than to a politician, he was respected both in the House and in the country. His political colleagues admired his knowledge and his urbanity. He also won respect for his independent mind, frank speech, and consistent action. He treated subjects on which he spoke in a fair, candid, impartial manner. He was trusted both by his colleagues and the general public as a man of his word. These aspects of his personality led to his being characterized as "Honest John" during the Home Rule controversy.

Between 1885 and 1896 Morley was one of the most popular speakers in the Liberal Party. However, as a speaker he was better in a set speech situation than in debate. His introverted nature and philosophical mind rebelled against seeking solutions to problems through debate. Deliberative speeches were better suited to his temperament and background. He excelled in statement, and his literary experience showed itself to good advantage. Morley's delivery was not good. His gestures were awkward and his voice was poor. He experienced difficulty in expressing his profound thoughts in a continuous flow of language. Yet his poor delivery, which contrasted with his fine literary style, philosophical thought, and earnest conviction, seems to have been a source of strength; he did not appear to be a professional politician.

Morley advocated Home Rule for Ireland on the grounds that (1) the Irish, as a people, were inherently entitled to their own government; (2) England misgoverned Ireland because she failed to take into account Irish needs and desires; (3) the Irish would rebel against English rule until England granted her Home Rule; (4) Home Rule would leave the English Parliament free to attend to English social and political problems.

Morley's language is studied according to its function. His use of logical language established him as a man willing to give information which could be verified. His use of expressive language revealed him to be a man of strong conviction. His use of ceremonial language reflected his good-will toward his auditors. His use of poetic language reflected his knowledge and identification with letters. His use of practical language revealed his means of winning sympathy for the Irish people. All language functions working together established Morley as a speaker worthy of attention.

The study indicates that ethical values attaching to Morley's person and character and emanating from his message and language usage were responsible for the high regard he earned as a speaker during the Home Rule agitation. 210 pages. $2.75. Mic 58-4504

A PHILOSOPHY FOR RHETORIC CONSTRUCTED FROM THE WRITINGS OF BERTRAND RUSSELL

(Publication No. 25,299)

Donald Lee Torrence, Ph.D.
University of Illinois, 1957

The philosopher, Maurice Natanson, presents in the April, 1955 Quarterly Journal of Speech an injunction to the rhetorician to seek the philosophical basis of his art. This study is a response to that injunction. It presents the views of the British philosopher, Bertrand Russell, on the presuppositions of rhetoric. With rhetoric defined as the use of words to influence the behavior of men, the thesis examines Russell's views of the nature of man and the causes of his behavior, the nature of language and how language influences behavior, and the ethical use of language in society.

Within the broad areas outlined above the following of Russell's concepts are revealed: First, man is differentiated from other events in a universe cold to man's

purposes by the characteristics of imagination and intelligence. Imagination furnishes him boundless desires, and intelligence furnishes the means of satisfying those desires. Second, the immediate causes of man's behavior, which can be explained by causal laws, are desires and beliefs. These causes of behavior can, in turn, be caused by outside influences, including language. Desires are akin to animal behavior; beliefs are distinctively human. Desires and beliefs are psychological states, but beliefs can be judged by facts which lie outside the organism. Thus, beliefs may be called true or false. Third, Russell believes words are the basic unit of language, and man learns their meaning by habit. Words, alone, are not sufficient to accomplish the complex functions of language; thus, we have sentences. It is the assertive or indicative capacity of sentences which influences behavior. What is indicated by a sentence is called a proposition. Propositions, which are verbalized beliefs, can be labeled true or false, like beliefs, according to their correspondence to the fact asserted. Fourth, Russell believes non-rational behavior is caused by language by directly causing emotions to arise, by creating beliefs that particular objectives are desired, and by creating beliefs based upon desires. Language causes rational behavior by creating beliefs based upon evidence rather than desire. With these two avenues of appeal possible, Russell postulates two kinds of argument, ethical and scientific. Ethical argument is concerned with ends and can appeal only to desires causing non-rational behavior. Scientific argument is concerned with means and appeals to evidence causing rational behavior. To cause belief some evidence is necessary in non-rational argument, and appeal to desire is necessary in rational argument; the difference between the two is a matter of degree. Finally, Russell believes the best form of society would satisfy the greatest number of personal desires compatible with social order. As an instrument of influence in society, language should be used ethically. The advocate should assert his propositions as probable courses for behavior, since certainty is beyond human power. He should appeal to evidence whenever possible, and appeal only to desires which create harmony rather than discord. And all points of view on any question should be afforded the opportunity for expression.

In general, a system of rhetoric based on Russell's presuppositions would stress three things: a heavy emphasis would be placed upon facts as the basis for conclusions and appeals to support those conclusions; appeals to desire would be sanctioned, but stringently controlled by ethical considerations, namely, that social harmony should be promoted by appeals to desire; and the role of rhetoric as an ethical and moral force in shaping society would be stressed.

Russell's views on the presuppositions of rhetoric reiterate some old ideas, throw new light on other old concepts, and furnish some new concepts for rhetoric. Similar studies of other philosophers might lead to a sounder philosophical basis for rhetorical doctrine.

116 pages. $2.00. Mic 58-4505

ZOOLOGY

POPULATION DYNAMICS AND TAXONOMY OF THE BAT PIPISTRELLUS SUBFLAVUS.

(Publication No. 25,205)

Wayne Harry Davis, Ph.D.
University of Illinois, 1957

The winter populations of the eastern pipistrelle, Pipistrellus subflavus, in two caves in West Virginia were studied extensively. One population consisted of 78 per cent males and the other 83 per cent males. There was a significant change in sex ratios within each population from year to year. These changes seem correlated with climatic conditions. The sex ratio of hibernating pipistrelles was found to be different at different latitudes, the preponderance of males decreasing from north to south.

There is a high mortality during the first two years, and a very high rate of survival beyond that time. Males over two years old survive at a rate of about 90 per cent per year, at least through their sixth year. Survival of females is about 60 per cent. This difference accounts in part for the sex ratios of hibernating populations. Wintering of females elsewhere is probably the other factor concerned.

Young are born in late June in West Virginia, in early June in Florida, and late May in Honduras. Two young is the usual number, although one, three, and four have been recorded. Different females within one region may give birth to young as much as a week or 10 days apart.

The preferred habitat of Pipistrellus subflavus contains large trees, water, and open spaces for feeding. They will not occupy the same feeding territory as little brown bats, Myotis lucifugus, but can be found together with most other species of the eastern United States.

In Vermont the epiphyses of the fingers have not closed when the young enter hibernation. Growth does not occur during hibernation, and specimens taken from these populations can be separated as young and adults. In the wintering caves of Kentucky some young of the year can be recognized by their epiphyses and some cannot. No young can be found with open epiphyses in the wintering caves of Florida.

Molt generally occurs in August. New hair comes in on all parts at once, so that a molt line is never evident. The new hair must come in rapidly, for few individuals are found in the process of molting. Young in Vermont have not molted when they begin hibernation. The process is usually, but not always, completed by this time in Kentucky.

Females average slightly larger than males. A great amount of variation in color occurs within any population.

Four subspecies of Pipistrellus subflavus are recognized. P. s. subflavus occupies most of the eastern United States. P. s. clarus inhabits a small area in Coahuila and part of Texas. P. s. veraecrucis inhabits the tropics of

Veracruz and Honduras. A previously undescribed form is found in peninsular Florida and coastal Georgia.
93 pages. $2.00. Mic 58-4506

THE GEOGRAPHIC VARIATION AND DISTRIBUTION OF THE LONG-TOED SALAMANDER, AMBYSTOMA MACRODACTYLUM BAIRD

(Publication No. 24,636)

Denzel Edward Ferguson, Ph.D.
Oregon State College, 1957

Major Professor: Robert M. Storm

The known distribution of Ambystoma macrodactylum Baird is presented and the nomenclatorial history of the species reviewed. The validity of the races A. m. macrodactylum Baird and A. m. krausei Peters as proposed by Mittleman is questioned. Concurrence is given to the recognition of A. m. croceum as a separate subspecies by Russell and Anderson. On the basis of color and color pattern of adult animals, four groups of A. macrodactylum (in addition to croceum) are recognized and referred to as the Eastern Oregon, Western Oregon, Crater Lake and Montana groups. Color descriptions of representative, living specimens of each group are given. Fairly constant geographic variation between the four groups has been demonstrated, involving distinctness, continuity, coloration, extent, and distribution of the dorsal band; ground color and guanophore distribution; eye pigmentation. Distinctive peculiarities and local deviants of each group are pointed out. Striking differences in larvae and recently metamorphosed individuals from the four areas were not detected. Sexual dimorphism involved in the vent is described.

All specimens within each group were pooled to form four samples for statistical analysis. A series of 14 measurements and counts was obtained from each specimen examined and from these data, ratios were formed by dividing the larger figure into the smaller. The following ratios were utilized to compare animals of the four groups: head length/ snout-vent; head length/ axilla-groin; head length/ percent of total length in tail; head length/ length of right front leg; head width/ axilla-groin; head width/ snout-vent; head width/ head length; band width/ head width; band width/ interorbital distance; internarial distance/ band width; interorbital distance/ axilla-groin; axilla-groin/ span hind legs; length of right front leg/ axilla-groin; percent of total length in tail/ total vomerine count. In addition, five ratios involving lens diameter were tested only between the Eastern Oregon and Western Oregon groups.

The means of these ratios were compared for animals of the four groups using a completely randomized factorial design and the analysis of variance based on the F distribution. For each ratio tests were made for area, sex, and interaction (sex x area) at the 1% significance level. If a significant F value was obtained for area the single degree of freedom was utilized in further tests to detect between which groups the indicated difference occurred. All F values for area were found to be significant; 10 significant F values were obtained in comparing the Eastern Oregon and Western Oregon groups; 11 in comparing Eastern Oregon and Montana; 9 in comparing Eastern Oregon and Crater Lake; and 12 in comparing Western Oregon and Crater Lake. Sexual dimorphism was indicated in 10 of the ratios tested and interaction was evident in five. All ratios involving lens diameter differed significantly.

Life history data pertaining to breeding, larval development and habitat are presented and compared between the four groups. Notes concerning food, enemies and size are included.

On the basis of the findings it is concluded that the species consists of five distinct subspecies as follows: A. m. macrodactylum represented by the Western Oregon group; A. m. krausei represented by the Montana group; A. m. croceum presently known only from Santa Cruz County, California; the Eastern Oregon and Crater Lake groups apparently representing heretofore unrecognized subspecies. The relationships of the subspecies are discussed and a key to the adult animals given.
94 pages. $2.00. Mic 58-4507

THE BIOLOGY AND CONTROL OF THE SCURFY SCALE [CHIONASPIS FURFURA (FITCH)] ON APPLES IN VIRGINIA

(Publication No. 24,498)

Clarence Howell Hill, Ph.D.
The Ohio State University, 1951

The biology of scurfy scale was studied in northern Virginia during the period 1947-51. This insect has two generations per year. It overwinters in the egg stage under the old scale covering. The eggs hatch during and immediately following the blooming period of apples.

The young nymphs crawl about for a few hours before settling and starting to feed on the apple trees. The male and female nymphs are not distinguishable in the first instar. The females have two nymphal instars. The males have three nymphal instars, the third instar being quiescent under the scale of the second nymphal instar.

The second instars form a scale covering. The male scale covering is long tricarinate with subparallel lateral margins; the female scale covering is subpyriform.

In Northern Virginia adult females begin to appear early in June and adult males just prior to the middle of June. The first gravid females were observed near the middle of June, and oviposition began the last week in June and continued throughout most of July.

The eggs from the first generation females started hatching about the middle of July. Relatively few individuals become adults before the middle of August.

During September and October, adults of the second generation deposited overwintering eggs. Most of the eggs were deposited after the middle of September.

The results of sleeve experiments to prevent access of males to females strongly indicate that fertilization is required by this insect for egg deposition and reproduction.

The adult male has two wings, is capable of flight, and lives from a few hours to about a day.

A mite, Hemisarcoptes malus (Shimer), was found to be predacious on both the scale insect and its eggs. This mite was the most important natural enemy of the scale insect. Two parasites were found to attack the scale

insect, Aphytis diaspidis Howard and Aphytis mytilaspidis LeBaron. The parasite population was quite low throughout this five-year period.

Experiments to control scurfy scale were conducted during the five-year period. In these experiments, paraffinic base oils were superior to the naphthenic base oils. Paraffinic base oils resulted in satisfactory control when used in a dormant or delayed dormant application at 3 per cent concentration.

Parathion applied in the petal-fall spray at the rate of four ounces of actual material per 100 gallons of spray gave excellent control of the scale.

Metacide and Compound 4049 (Malathon) showed promise as a control measure when used at relatively high concentrations.

DDT is effective in killing the "crawler" nymphs, but it is not a satisfactory control measure because some of the nymphs remain under the old scale covering and do not come into contact with the insecticide.

There was no significant difference at the 5 per cent level in the control effected by the paraffinic oils at 3 per cent concentration and parathion when used as previously mentioned, except in the second generation sampling of the 1950 gest. These materials were significantly more effective than the following materials at the indicated concentrations in 100 gallons of water: oil (naphthenic base), 3 per cent; DN-289, two quarts; D-296, four pounds; Elgetol, four quarts; and EPN-300, two pounds.

78 pages. $2.00. Mic 58-4508

Abstract published by special arrangement with The Ohio State University.

DIGENETIC TREMATODES IN LOUISIANA FRESH-WATER FISHES

(Publication No. 24,720)

Grover Cleveland Miller, Ph.D.
Louisiana State University, 1957

Supervisor: Harry J. Bennett

The parasitic fauna in Louisiana fresh-water fishes is practically unknown and this fact encouraged the writer to undertake the present studies. There are two distinct groups of people who would be interested in such studies. First, the sport and commercial fishermen of the state would be interested from a recreational and economical point of view. Second, the information derived from such research would fill a considerable gap in the scientific knowledge of the fauna in the state.

This study is not a simple survey project. An attempt is made to present a comprehensive treatment of the biology and ecology of the digenetic trematodes in fresh-water fishes of the state.

The classical methods of collection and examination of fish hosts were utilized throughout this study. Most of the hosts were obtained from personnel of the Louisiana Wild Life and Fisheries Commission but many were obtained from sport and commercial fishermen. Some were directly acquired by the writer through angling and by the use of nets. All parasites were collected, recorded and preserved for study but only the digenetic trematodes are reported in this study.

A total of 629 fish, representing fourteen families, twenty genera, and thirty-one species were collected and examined during the years 1954 to 1957. The majority of these were game fishes. These hosts were collected from twenty-six different localities which ranged throughout the state and collections were made during all months of the year.

A total of nineteen species of digenetic trematodes, representing eleven families and seventeen genera, were identified and studied. One of these has been described as a new species. New information has been presented on the biology of these worms in regard to their morphology, taxonomy, ecology and distribution.

The nineteen species of trematodes are as follows: Phyllodistomum lacustri, Phyllodistomum parvulum n. sp., Allocreadium ictaluri, Homalometron armatum, Crepidostomum cornutum, Macroderoides typicus, Glossidium corti n. comb., Cryptogonimus chili, Caecincola parvulus, Neochasmus labeosus, Allacanthochasmus varius, Allacanthochasmus artus, Holostephanus ictaluri (?), Diplostomulum sp., Neascus, sp., Clinostomum marginatum, Pisciamphistoma stunkardi, Halipegus perplexus and Cotylogaster occidentalis. The last named species is actually an aspidogastrid but was included in this study because of its close relationship with the digenetic flukes.

Sixteen of the nineteen species of trematodes reported in this study are recorded as new to Louisiana. The three which have previously been reported are: Crepidostomum cornutum, Neochasmus labeosus and Cotylogaster occidentalis.

The larval forms of Neascus and Diplostomulum are treated as generic groups but subsequent work will undoubtedly show that a number of species are involved.

It was anticipated at the beginning of this study that a number of forms new to science would be encountered. However, this was not the case as only one new trematode was found during the entire study. This may be partially explained by the fact that nearly all of the Louisiana waterways are either directly or indirectly connected with the Mississippi River drainage system. With this fact in mind it was not too surprising to learn that the parasitic forms found here are very similar to those found in the more northern areas drained by the Mississippi River.

The digenetic trematodes were the most commonly encountered parasites in Louisiana fishes. This included both the number of species and the number of individuals. Of the 629 fish examined, 386 or 61.3 per cent were infected with some species of digenetic trematode.

143 pages. $2.00. Mic 58-4509

SOME HORMONAL AND MECHANICAL FACTORS AFFECTING LIMB REGENERATION IN AMPHIBIA

(Publication No. 25,254)

Merle Mizell, Ph.D.
University of Illinois, 1957

A. Non-regenerating System (Frog)

This investigation lends support to the importance of the adrenal cortex in amphibian limb regeneration, for treatment with cortisone and with salamander adrenal transplants in the frogs, which normally are incapable of limb regeneration, resulted in some cases of limited regeneration.

While these regenerates are abnormal in some respects, they still represent a capacity not normally found in adult Anurans.

B. Regenerating System (Adult Salamander)

An attempt was made to block regeneration in the salamander by introducing a rod in the limb stump, in order to simulate the uneroded bone in a non-regenerating system.

The physical presence of the rod may (1) block regeneration, and/or (2) delay regeneration, and/or (3) cause dermalization and callus formation, and/or (4) cause the blastema to form ventrally and therefore produce a ventral outgrowth that later can regulate and become integrated with the proximal portion of the limb. The physical presence of the rod, in relation to the stump, determines whether or not regeneration will occur and, if so, the type and appearance of the regenerate.

A new use for the Contact Therapy X-ray Machine is described. This use provided a visualization of the internal structure of the salamander limb. By means of X-rays it was possible to follow chronologically in the same animal, some of the internal changes during (or in the absence of) regeneration.

Information gained from these two systems is discussed, and the problem of regeneration vs non-regeneration is commented upon in view of these results.

52 pages. $2.00. Mic 58-4510

THE EXTERNAL AND INTERNAL MORPHOLOGICAL CHANGES DURING METAMORPHOSIS IN THE WORKER HONEYBEE APIS MELLIFERA LINNAEUS

(Publication No. 24,077)

Willard Cochran Myser, Ph.D.
The Ohio State University, 1952

The research is an attempt to describe the external and internal morphological changes that occur in the honeybee from the time of hatching up to the time the pupa is developed. Some of the most extensive changes in form take place between the last larval stage and the pupal stage. Thus the author has tried to correlate the external changes with those that occur internally especially during this interval. Since metamorphosis is a continuous process in honeybees, it was necessary to secure and examine the material for study at regular intervals. Drawings were made of the larvae, prepupae, and pupae to indicate the sequence of the external morphological development. The internal morphological changes are also illustrated by a sequential series of drawings of sectioned material.

The author has tried to illustrate the gross relationship of the various parts rather than the minute histological changes in an organ or system, and to describe metamorphosis as a continuous, gradual change rather than an abrupt or striking one.

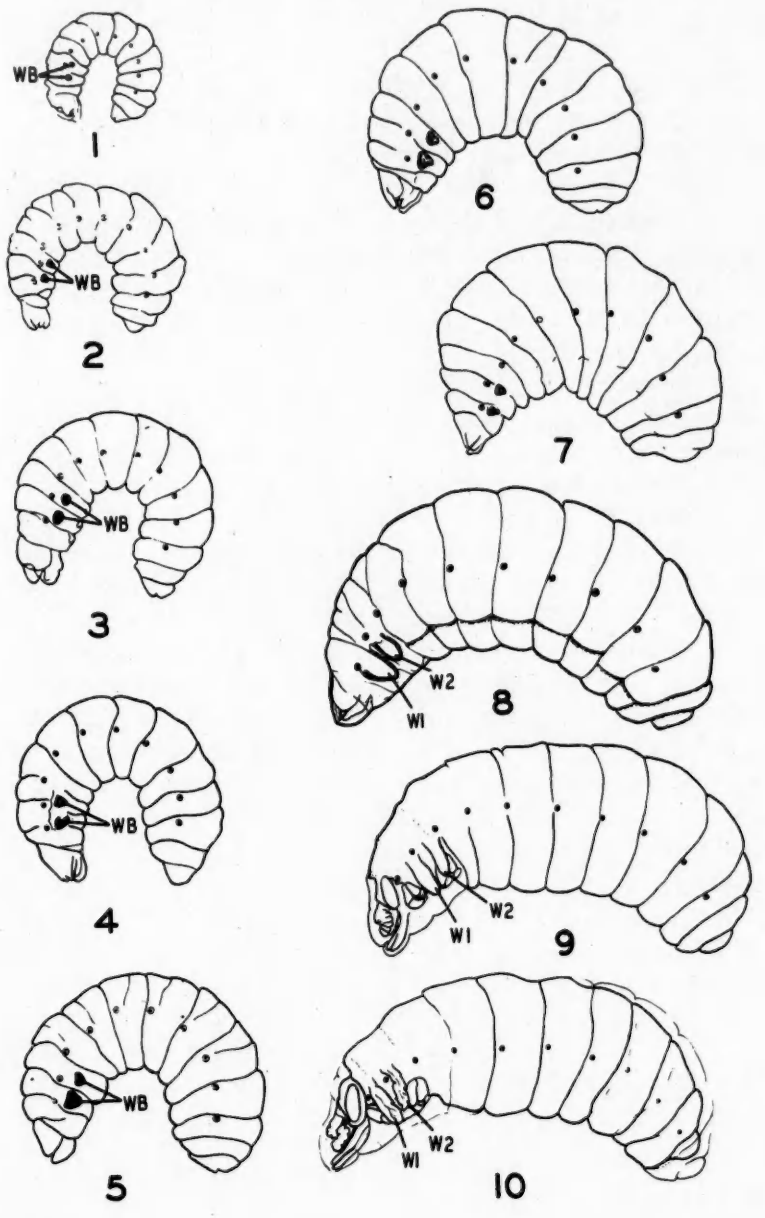


Plate I: Fig. 1. Lateral view of a day old larva; Fig. 2. Lateral view of an early two day old larva; Fig. 3. Lateral view of a late two day old larva; Fig. 4. Lateral view of an early three day old larva; Fig. 5. Lateral view of a medium three day old larva; Fig. 6. Lateral view of a late three day old larva; Fig. 7. Lateral view of a four day old larva; Fig. 8. Lateral view of a full grown five day old larva or day of capping larva; Fig. 9. Lateral view of a six day old larva or one day after capping larva, early prepupa; Fig. 10. Lateral view of a seven day old larva or two days after capping larva, prepupa.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

EXTERNAL CHANGES IN MORPHOLOGY DURING METAMORPHOSIS

The development of the wings, legs, mouth parts, and gonapophyses in the honeybee can be followed from the day of hatching through pupation.

In the one day old larva the wing buds can be seen as small, white spots of tissue on the lateral surfaces of the second and third thoracic segments. The larval antennae and mouth parts are easily seen at this stage. On the ventral side of the thorax are three pairs of disc-like spots, the leg buds.

In the two day old larva the legs, wings, and gonapophyses are developing in hypodermal pockets. The legs can be seen segmenting at this stage, and the wing buds and gonapophyses are longer and more easily distinguished.

During the third, fourth, and fifth days of larval life, although the head remains essentially the same size, the body increases in length and breadth and the appendages increase in length and become differentiated.

During the sixth, seventh, and eighth days of larval life, the head, thorax, and abdomen of the pupa can be seen developing beneath the larval cuticle which has separated from the pupal cuticle. The pupal head has enlarged, and the thorax has narrowed. The eyes also have enlarged on the sides of the head and appear creased and wrinkled. The mouth parts appear as long, fingerlike projections extending cephalad on the head. The antennae lie against the front of the head in an S-shaped pattern. The gonapophyses are now long and slender and have everted from the hypodermal pockets. The individual leg segments can be recognized even though they are folded on the ventral side of the thorax. Eight days after hatching the larva is in its most advanced stage of development and is called the propupa.[1]

PUPATION

When the larval skin ruptures preceding the fifth moult the whole body surface of the pupa appears wrinkled. The wings, legs, mouth parts, antennae, and gonapophyses appear as flat, folded, deflated, wrinkled sacs adhering tightly to the thorax, head, and abdomen respectively. The head and thorax are narrower than the abdomen, and the head is separated from the thorax by a distinct constriction.

When a specimen of this age is dropped into KAAD[2] killing solution, it swells, and the observer can see the phenomena of pupation much speeded up. The wings unfold and become free of the thorax. They then rotate caudally. The head begins to enlarge, and the mouth parts begin to unfold and rotate in a ventral arc until they extend caudad. The distal segments of the legs become free of the thorax and come to lie on the thorax dorso-laterally. The antennae also straighten out, and the distal segments which extended cephalad in the propupa now rotate and extend caudad. After these appendages cease expanding and rotating, the early pupa has become morphologically formed.

About twenty-four hours later, nine days after hatching, the bee has assumed its adult shape. The leg segments, wings, mouth parts, antennae, and gonapophyses are more slender, and the pupal cuticle covers them as a thin, transparent layer. The animal still appears white in color.

As the pupa continues its development, the most apparent changes are in pigmentation of the body parts. The last (sixth) moult occurs nine days after the previous (fifth) larval moult, and the imago emerges from its cell.

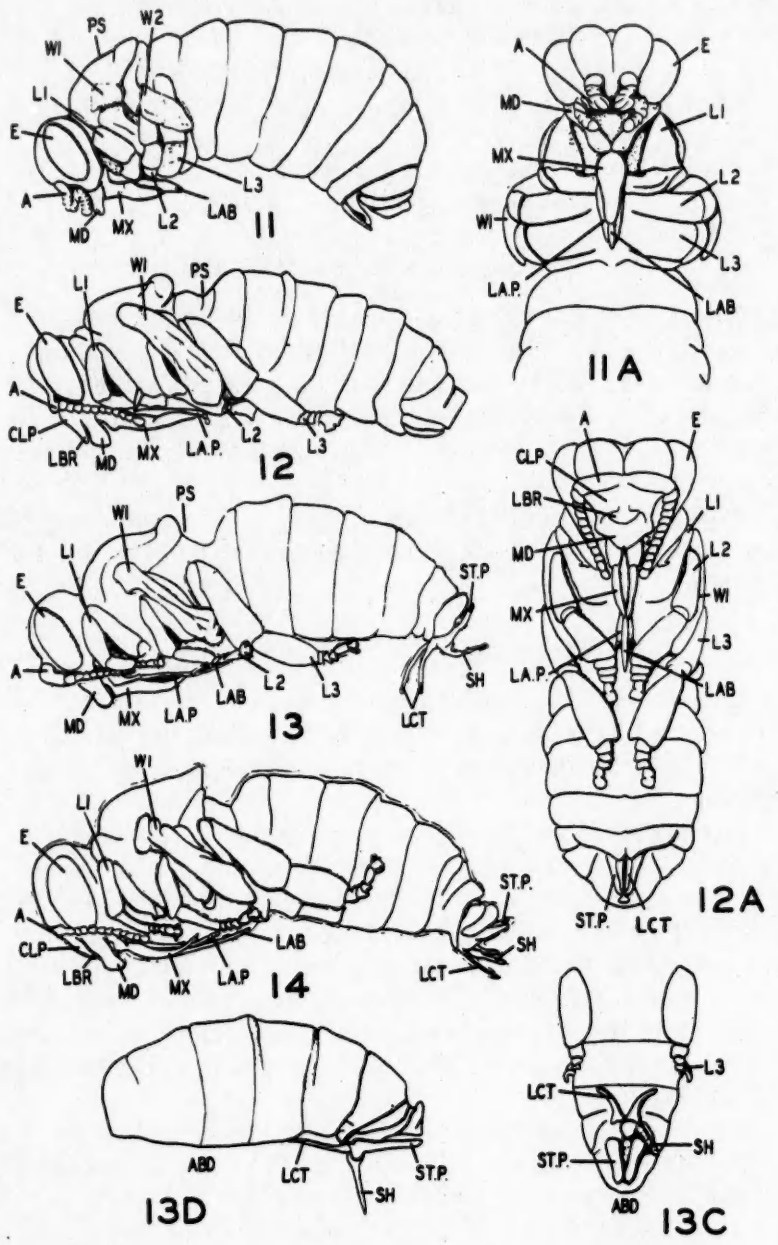


Plate II: Fig. 11. Lateral view of an early pupa; Fig. 11A. Ventral view of the head and thorax of an early pupa; Fig. 12. Lateral view of a late three days after capping pupa; Fig. 12A. Ventral view of a late three days after capping pupa; Fig. 13. Lateral view of an early four days after capping pupa; Fig. 13C. Ventral view of the last four abdominal segments of an early pupa showing the parts of the stinger; Fig. 13D. Lateral view of the last four abdominal segments of an early pupa showing the parts of the stinger; Fig. 14. Lateral view of a late four days after capping pupa.

INTERNAL CHANGES IN MORPHOLOGY DURING METAMORPHOSIS

Serial sections of the bees showed cuticular modifications which correlated with the external changes just described. The sectioned material also revealed the changes in the relationship of the internal organs of the head and thorax from day of capping through four days after capping.

In the five day old larva, day of capping, the conical-shaped head is only about one-half the diameter of the thorax and is separated from it by a dorsal groove. The segmented antennae are developing in hypodermal pockets.

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The legs and wings and their development in the hypodermal pockets of the thorax can be seen plainly at this stage. Also noticeable is the beginning of the separation of the larval cuticle from the pupal cuticle in the head and thorax.

The fat bodies are in scattered groups throughout the thorax, but very few are in the head proper. The dorsal vessel lies just beneath the cuticle in the abdomen and thorax on the dorsal mid-line. The silk glands are paired, tubular, convoluted structures in the thorax which unite in the head and open at the tip of the labium-hypopharynx. The oesophagus is a narrow tube running caudally from the anterior tip of the head to the prothorax where it joins the mid-gut. The mid-gut, as described by Dobrovsky,[3] is a large "crescent shaped tubular bag" about one-third to one-half the diameter of the body.

In the eight day old larva, propupa, the constriction between the head and thorax has deepened, and the two regions are joined by a narrow stalk. The head is larger and more elongate than in the day of capping larva, while the thorax and abdomen are becoming narrower. The labium, labial palpi, maxillae, and mandibles are long, hollow, fingerlike projections extending cephalad.

The fat bodies can now be found in the head proper. The dorsal vessel is imbedded in fat bodies that lie beneath the dorsal cuticle of the body.

The mouth opening is still anterior, but the pharynx turns upward for a short distance, then caudally into the oesophagus. The oesophagus also extends caudally until it abuts with the mid-gut in the abdominal region. The mid-gut is at this stage a long, narrow, tubular sac, the same as the oesophagus.

PUPATION

Immediately after the shedding of the last larval skin, the appendages of the pupa begin to change their relative positions. The hypodermis of the cuticle appears thicker, indicating that it is probably in an active secretory state. The sections reveal that the appendages of the head and the proximal segments of the legs now extend caudad or ventro-caudad. The mandibles, maxillae, and labium appear much broader at their bases; they are no longer fingerlike in appearance.

The head has enlarged, making the brain appear proportionately smaller. A few fat bodies can be seen in the head, but they are now more concentrated in the thorax and abdomen.

In the four days after capping pupa most of the adult characteristics are determined. The thorax and abdomen are separated by a deep dorsal fold. The sternal plates of the abdomen are more completely formed and are beginning to overlap.

The fat bodies are numerous, small, and distributed equally in the head, thorax, and abdomen.

The honey stomach mid-gut extends well into the thoracic region and is now an enlarged sac-like structure. The epithelium of the mid-gut is more definitely formed than in the previous pupal stage.

The heart follows the cuticle through the constriction of the thorax and abdomen, and then the aorta proceeds anteriorly and embeds in the thorax about halfway between the dorsal cuticle and the mid-gut. In the prothorax the aorta runs at a gentle ventral angle until it passes beneath the prothoracic trachea and then into the head.

80 pages. $2.00. Mic 58-4511

1. Snodgrass, R. E. Anatomy and Physiology of the Honeybee. New York: McGraw-Hill Book Co. Inc., 1925, p. 327.

2. Peterson, Alvah. Larvae of Insects, Lepidoptera and Hymenoptera Part 1. Ann Arbor, Michigan: Edwards Brothers, Inc., 1948.

3. Dobrovsky, T. M. "Postembryonic Changes in the Digestive Tract of the Worker Honeybee," Apis mellifera L. N. Y. St. Coll. Agr. Bul., M. 301 (1951), p. 45.

Abstract published by special arrangement with The Ohio State University.

STUDIES ON THE SURFACE ANTIGENS OF STOCKS 169 AND 51 OF PARAMECIUM AURELLIA, VARIETY 4: I. GENETIC ANALYSES OF MUTATIONS INVOLVING SEROTYPE H, STOCK 169, PARAMECIUM AURELIA. II. CHEMICAL STUDIES OF SEROTYPE A, STOCK 51, PARAMECIUM AURELIA.

(Publication No. 24,567)

Alexander Herbert Reisner, Ph.D.
Indiana University, 1957

Stock 169, variety 4 of Paramecium aurelia has been shown to exhibit nine serologically distinct surface antigens: A, B, C, D, E, F, H, M, and N. The possibility that the stock has the potential to manifest others is not excluded.

The patterns of serotype transformation of surface antigens B, C, and H were studied under conditions of excess food at the temperatures: 10^0, 14^0, 19^0, 27^0, 31^0, and 35^0. In general these transformation patterns were shown to be comparable to those patterns exhibited by other stocks of variety 4, i.e. at any given temperature only a limited number of the nine possible serotypes came to expression.

From cultures subjected to an X-ray dose of 4,000 r, three detectable independent mutations which block the synthesis of surface antigen 169H were obtained. Breeding analyses indicate that the three mutations are allelic to one another and to the H^{169} gene, the gene which controls the serological specificity of surface antigen H. There are several alternatives to the concept of an amorphic mutation of the H^{169} gene: 1) a quasi-amorphic effect could be caused by a chromosomal aberration, e.g. an inversion, a deletion, or a translocation. 2) Some second locus, closely linked to H^{169}, mutated to become a neomorph which would cause the production of a substance inhibiting the synthesis of 169H antigen. 3) It is possible that a chromosomal change occurred causing a position effect inhibiting the production of 169H antigen.

Under the experimental conditions used for the X radiation three apparently amorphic mutations of H^{169} were known to have occurred independently in 168,000 genomic sets. Thus the minimum rate of mutation for this locus is equal to $4.5 \times 10^{-9}/r$.

A water soluble extract of the surface substance of Paramecium aurelia stock 51 serotype A was obtained by suspending the cells in an inorganic salt solution, pH 6.5, for 24 hours, centrifuging the suspension at 2,000 g to remove the animals and then at 159,000 g to remove all small particulates. The supernatant was dialyzed for 96 hours and then lyophilized. The impermeate was

hydrolyzed with 0.1N HCl and the hydrolyzate was analyzed by means of descending one dimensional paper partition chromatography. The components of the substance were identified as galactose, xylose, glucuronic acid, aspartic acid, glutamic acid, and alanine. Immunological analysis of unhydrolyzed samples of the surface substance established that the only surface antigen present was 51A. It is concluded that this surface antigen is a non-dialyzable polysaccharide, or polysaccharide-peptide complex.

85 pages. $2.00. Mic 58-4512

THE INHIBITION OF GROWTH IN CROWDED RANA PIPIENS TADPOLES

(Publication No. 25,272)

Christina Macgregor Richards, Ph.D.
University of Illinois, 1957

It has been demonstrated repeatedly that tadpoles raised under crowded conditions have a reduced growth rate, but there is little agreement on the underlying cause, and no explanation thus far advanced has been completely satisfactory in explaining all observations.

Rather than actually crowding the experimental animals, an assay system was used in which four small tadpoles were grown in a liter of water previously occupied by 12 or more large tadpoles for two days. Water crowded in this way and called here crowded water, almost stopped the growth of the assay tadpoles completely. The crowded water was then treated in various ways to learn something of its properties and the treated crowded water was used as the growth medium for assay tadpoles. The assay tadpoles were fed optimally and it was demonstrated that reduced oxygen was not the cause of the inhibition. Centrifugation and filtration studies showed that the inhibitory material was of the order of size of cells, smaller than forty microns but larger than bacteria. None of a wide variety of enzymes including trypsin, papain, proteinase, amylase, lipase, RNAase, DNAase, hyaluronidase attacked the inhibitory material but heat, ultraviolet irradiation, sonication, freezing, and pH3 buffer all destroyed its activity. The source of the inhibitory factor in crowded water was found to be the feces, and further study showed that the gut contents of a single large tadpole was inhibitory to the growth of the small assay tadpoles. Microscopic examination of the feces from a stunted tadpole revealed that it was tightly packed with colorless round, vacuolated cells 5-19 microns in diameter. There is a clear correlation between the presence of these cells and growth inhibition, a fact which implicates them as the causative agent. Whether the cells are a part of the tadpole or are of outside origin is unknown. Attempts to culture them outside the tadpole have been unsuccessful.

Thus, when oxygen and food are not limiting, crowded tadpoles are inhibited in their growth by a peculiar cell type found in the fecal material. This interpretation is consistent with the observations of all other authors who have studied the crowding effect in tadpoles.

37 pages. $2.00. Mic 58-4513

REGENERATION IN ADULT MAMMALIAN SKIN AFTER WOUNDING

(Publication No. 23,456)

William Edwin Straile, Ph.D.
Brown University, 1957

In this investigation, the alterations in the area of skin adjacent to contracting wounds on the back of guinea pigs were studied. Measured changes in tattooed co-ordinate fields, surrounding the contracting wounds, demonstrated that the expansion of skin peripheral to the wound made a substantial contribution in replacing the skin removed during injury. A logarithmic decrease in skin expansion occurred peripherally from the anterior and posterior borders of wounds which were contracting primarily in an anterior-posterior direction. In wounds that were contracting anterior-posteriorly and laterally, the skin along the wound border converged centripetally toward the center of the wound. This resulted in a reduction in the tangential tension of the skin at the wound border. Accompanying this decrease in tension was a tangential shrinkage of the skin. The interaction of radial expansion and tangential shrinkage at the wound border may lead to expansion, contraction, or merely a change in shape at different locations along the wound border. Expansion in the anterior-dorsal skin of the guinea pig, which was loosely attached to the underlying muscle, was not significantly different from the pattern of expansion in the posterior-dorsal skin, which was much more tightly attached.

The composition of normal skin was compared with the composition of skin that had expanded for 18 days. Histological data on the changes that occurred in strips of skin that were rapidly expanding between two wounds indicated that the thickness of the skin increased slightly during expansion. Biochemical studies showed that the maintenance of skin thickness during expansion was mainly due to an increase in water, albumins, and/or globulins. These changes were accompanied by an increase in the number of fibroblasts in the dermis, a hyperplasia of the epidermis, and an enlargement of the spaces between collagen fibers of the dermis. The fibrous framework of the dermis, which is primarily made up of collagen fibers, was diluted during the early stages of expansion. No significant synthesis of collagen was demonstrated in the guinea pig.

Another portion of this investigation deals with a study of the possibility of neo-formation of hair follicles in the wounds of adult rabbits. Chambers which were designed by Breedis[1] to prevent the centripetal contraction of skin into wounds, were ineffective in preventing contraction under the conditions described here. Hair follicles at the periphery of the wounds that were healing within chambers, converged toward the center of the wound and repopulated the entire wound area except for a small scar in the center which remained hairless. The presence of the 7, stainless steel prongs, piercing the skin at equally spaced points along the circumference of the chamber, did not significantly impede the movements of the skin.

Although it has been stated that 7,12-dimethyl-2,3-benzanthracene destroys hair follicles completely in the mouse, and new hair follicles later develop from the epidermis, another explanation is more plausible. The reappearance of labeled follicles that had been treated with one and two applications of the carcinogen indicated that the epithelial components of the hair follicles were not

completely destroyed. Because the carcinogen was ineffective in destroying the follicles in the treated areas, the reappearance of hairs after healing was attributed to the restitution of damaged hair follicles, rather than to a de novo formation.

When re-examining the phenomenon of hair follicle neo-genesis, greater caution should be exercised in the interpretation of morphological data that indicate a neogenesis of hair follicles. Whenever possible, techniques that make possible the tracing of individual follicles, or groups of follicles, should accompany histological evidence.

107 pages. $2.00. Mic 58-4514

1. Breedis, C. 1954 Regeneration of hair follicles and sebaceous glands from the epithelium of scars in the rabbit. Can. Re. 14:575-579.

HABITAT DISTRIBUTIONS OF BIRDS AND MAMMALS IN LOSTINE CANYON, WALLOWA MOUNTAINS, NORTHEAST OREGON

(Publication No. 24,653)

Franklin Wright Sturges, Ph.D.
Oregon State College, 1957

Major Professor: Kenneth L. Gordon

Lostine Canyon on the north side of the Wallowa Mountains was chosen for a study of bird and mammal communities. The investigation was an attempt first to obtain information about the animals' selections of specific features of their environments, and second, to compare the findings with several systems of habitat classification and description.

The whole area has had a very complex geological history. There are three types of rock exposed. These include several thick layers of sediments, large areas of granodiorite, and flows of Columbia River basalts. There has been much folding, faulting, and uplifting. The present landforms show conspicuously the effects of these movements and the sculpturing by rivers and glaciers.

The area is characterized by a continental climate which is moderated by the prevailing westerly winds from the Pacific Ocean. Within this framework there is a wide variety of microclimate due to differences in exposure, elevation, vegetation, etc. Precipitation joins with the steep topography to make the substrate very unstable in many areas.

The Nez Perce Indians probably had little effect on the area. About 1900 large numbers of sheep were summered in the mountains by white men and severe over-grazing resulted. About 1920 there was a devastating fire in the lower part of the canyon. There has been a steady increase in the recreational use of the canyon. In 1940 the Eagle Cap Primitive Area was established.

It was recognized that certain physical features are necessary for some animals to be present in an area. Rocky soil, boulders, solid rock, streams, lakes, logs, snags, wires, clearings and buildings are the features defined.

The vegetation is described in terms of its structure. Each unit of characteristic physiognomy and species composition is called a union. There are five tree unions, two seven shrub unions, and seven herb unions discussed. When two or more unions were frequently found together, the assemblage is called an association, of which there are fifteen. Two elevational zones are recognized. The lower zone has twelve of the fifteen associations.

There are 76 species of birds and 32 species of mammals listed. Of these, 32 birds and 14 mammals were not seen frequently enough to comment on abundance or habitat preference. The rest are characterized as "occasional," "common," or "abundant." It was not practical to attempt to record relative or absolute numbers. Some species showed a rather narrow choice of habitat, e.g., Townsend's warbler, golden-crowned kinglet, dipper, Richardson's vole, and water shrew. Others were satisfied by a wider range of conditions.

Several schemes of habitat classification are discussed in relation to the information obtained in this study. These schemes are life zones, biotic provinces, biomes, growth form, and Daubenmire's classification of the forests of the northern Rockies. There seem to be features common to all these schemes, i.e., provision for units of about the magnitude of Merriam's vertical belts of vegetation in mountainous areas and units of smaller size within these belts. It is the larger categories which do not seem to agree. Most of the schemes do not allow for very small communities nor do they have units for recognition of physical features. 136 pages. $2.00. Mic 58-4515

IDENTIFICATION AND MICROANATOMICAL STUDY OF A NEW SPECIES OF EPIZOANTHUS (ZOANTHIDEA)

(Publication No. 24,608)

Richard Lyman Wood, Ph.D.
University of Washington, 1957

Zoanthids collected from various localities in Puget Sound are described as a new species, Epizoanthus scotinus and notes on its distribution are recorded. The anatomy of these animals has been studied in detail histologically and compared with other zoanthids, an actinian and a cerianthid.

A type of microbasic p-mastigophore nematocyst, not formerly known to be present in zoanthids, occurs in the epidermis of the pharynx and column wall of E. scotinus. Packets of developing holotrichous isorhiza nematocysts have been observed during examination of microscopic sections of solenia. Such a localized site of holotrich formation has not been described in other anthozoans.

In E. scotinus septal filaments occur only on macrosepta. As is typical in zoanthids, very prominent ciliated streaks are developed. The cnidoglandular streak is differentiated into two histologically distinct regions which are described in detail.

Large, granular wandering cells are present in all tissues of E. scotinus. These wandering cells have been observed undergoing cnidogenesis, participating in the formation of germ cells and contributing to the phenomena of asexual reproduction, regeneration and normal coenenchyme growth. A close relationship between wandering cells and muscle fibers is noted and an

association between these cells and muscular contraction is inferred.

Branches of gastrodermal muscle fibers which resemble the mesenchymal muscle fibers of ctenophores are present in the mesogloea of E. scotinus. Fibrous branches similar to these but smaller in size have been observed in other zoanthids during this study. Peculiar spindle-shaped structures associated with muscle layers in Cerianthus are compared with the muscle branches of E. scotinus.

There is no "canal system" in the mesogloea of E. scotinus. Zoanthids with well developed "canal systems" have been examined and the so-called canals are seen to consist of cordons of cells which connect freely with the epidermis. Special portions of this anastomosing system in Isaurus and Zoanthus are associated with the longitudinal musculature of the septa. It is pointed out that this fibrous, branching system may correspond to a specialized conductile pathway which has been postulated for actinians.

Observations on gametogenesis in E. scotinus are recorded. The formation of gonadal swellings by special folding of the septa is described. The manner in which developing ova obtain nutrients is noted and discussed. A special epithelial cell apparatus associated with developing sperm follicles in E. scotinus is compared with similar structures arranged both at the surface of sperm follicles and of developing ova in other Anthozoa. Possible functions of this cellular apparatus are discussed.

132 pages. $2.00. Mic 58-4516

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PART II

MONOGRAPHS

ANTHROPOLOGY

A SOLUTION TO KINSHIP AND SOCIAL ORGANIZATION AND A THEORY OF HUMAN GENETIC SYSTEMS

(L. C. Card No. Mic 58-1313)

Burt W. Aginsky, Ph.D.
Columbia University, 1935

This volume contains a presentation of the further developments in the fields of kinship and human genetics by the author. The abstraction of the invariant factors in a universal interrelationship and the quantification of them made possible the establishment of an experimental laboratory where all reported cases were constructed. It made clear the interrelatedness of the two fields mentioned in the title and the establishment of the universal equation applicable in both fields.

The Universal Equation: A = (MG)(WG)⌄(WG)(MG). A represents the force sex, M (man), W (woman), G (generation), ⌄ (marriage between or among). Initially, quantities of these are represented by s (one), and p (more than one). After the values are ascertained for M, W, and G, exact quantities are substituted.

It was found that any change in A is accompanied by a simultaneous and proportional change in; (1) the kinship system, (2) the human genetic system, (3) the form of marriage, and (4) the quantity of: (a) individuals in the marriage group, (b) nuclear families, (c) individuals in the nuclear families, (d) individuals in the affinal and consanquineal nuclear families, (e) individuals in the total population, (f) bio-cultural relationships, (g) individuals in the relationships, and, (h) families in the total population.

Scientific Methods utilized: A, marriage. 1) collection of reported cases, 2) comparison and analysis without regard to time or space (place), 3) establishment of the Primary and the 5 Secondaries as the basic forms, 4) combining the 5 Secondaries into 26 compounds which, with the Primary and the 5 Secondaries, result in a total of 32, (these include the tertiary forms of marriage).

The 32 forms are presented in two major series each of which contains 4 minor series. The 2 major series are presented in a mathematical progression and then in a three-dimensional cube.

Finding: Every known form of marriage is included in the 32.

Scientific Methods utilized, B: Kinship Systems and Social Organizations. 1) Collection of the reported cases, 2) comparison and analysis without regard to time or space (place), 3) categorization into three major varieties.

A laboratory was established and experiments carried out. 32 kinship and human genetics systems were constructed by varying the quantity of one or more of the factors. These are pure kinship systems.

The laboratory constructs were compared with the reported kinship systems.

Finding: Every reported kinship system was included in the 32.

Human Genetics. Since the force sex is manifested in 32 nexi of individuals there are also 32 differential quantitative genetic resultants and human genetic systems. This provides an additional insight which may aid the human geneticists in explaining the quantitative variation in populations of those characteristics which are hereditary, such as, for example, susceptibility to disease, hair form, coloration, and blood type.

Research on the effects of radioactive fallout upon the populations of the world should include these findings since there still remain many populations with different human genetic systems. Furthermore, since the radioactive fallout is reported to be uniform in the world (and thus may be considered a constant in scientific work) and should only the single traditional gauge in human genetics be used (also a constant), variation in effects may be explained incorrectly. The particular human genetic system must be ascertained.

Earlier presentations by the author:

KINSHIP SYSTEMS AND THE FORMS OF MARRIAGE, Memoir No. 45, American Anthropologist, 1935.
THE BIO-SOCIAL LAWS OF SOCIETY, University Microfilms, Publication No. 15,460, Ann Arbor, 1955.
A THEORY OF CULTURAL GENETICS, Human Biology, Vol. 27, No. 4, Dec. 1955. Pages 249. $3.25.

DEEP VALLEY: A PRESENTATION OF THE POMO INDIANS

(L. C. Card No. Mic 58-1314)

Burt W. and Ethel G. Aginsky, Ph.D.
Columbia University, 1935

This volume contains a presentation of the culture of the Pomo Indians of California before the penetration of the "white man". It is the result of field and library research begun in 1932.

There were three main periods of study in the field, from 1934-1936, 1939-1942, and 1946 to the present. Funds for this work were supplied by the Columbia University Social Science Research Council, New York University, The Social Science Research Council, Syracuse University, The Wennegren Foundation of Anthropological Research, and many other private sources.

The culture of the Pomo is presented as that culture functioned and as it was taught to the younger members, or as incidents were discussed against a background of the culture by the people themselves.

Much of the material was obtained from a number of informants. This was true of conversation, events, interpersonal relations, and ceremonies. In every case plural informants were used for checking accuracy of translation

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and information. Reactions of individuals to events and occurrences, positive and negative views of individuals with reference to the structure of their culture, incipient and actual rebellions, all are presented.

The Pomo had no writing, but they had trained their memories to so great an extent and had so ritualized almost every action that we have many cases where exact wording used by one indian pertaining to a conversation which had occurred in his youth would be duplicated by other indians who were present at the same occurrence. As an example of their memory training it may be noted that a professional, as, for example, a doctor, fisherman, gambler, or religious leader memorized well over a thousand songs which he had to use in exact combination to bring about desired results.

In the process of checking the information it was found that age, sex, occupation, family affiliation, play-group affiliation, and so on, affected the data. Thus a plural number of informants from every category and combination of categories were used whenever possible.

Not only the thoughts, beliefs, and attitudes were reported, but the behavior as well; it was found that there was often a difference between the activities and the ideas. The modal person was used, as well as the deviant and even extreme deviants, both positive and negative. The research techniques and methodology used and developed in the study are referred to in the bibliography.

Every situation presented, and every individual who speaks is a reality as of the time when the first intensive contact with westerners began, i.e., the second half of the nineteenth century.

Perhaps the presentation, true to life, of one case of a people who live an holistic life of their own, ecologically adjusted to their geographical, cultural, and intertribal environment, may aid in correcting the popular version of the feathered indian on horseback. Perhaps this presentation may make clear that the American Indian did not lead a simple life, was not a savage, and was not ignorant.

Aside from the names listed in the bibliography, there were thirty-two scientists who worked on this project under the supervision of and in conjunction with the authors. These individuals represented the various social sciences known today. They contributed much to the total study of the culture. 292 pages. $3.75.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

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